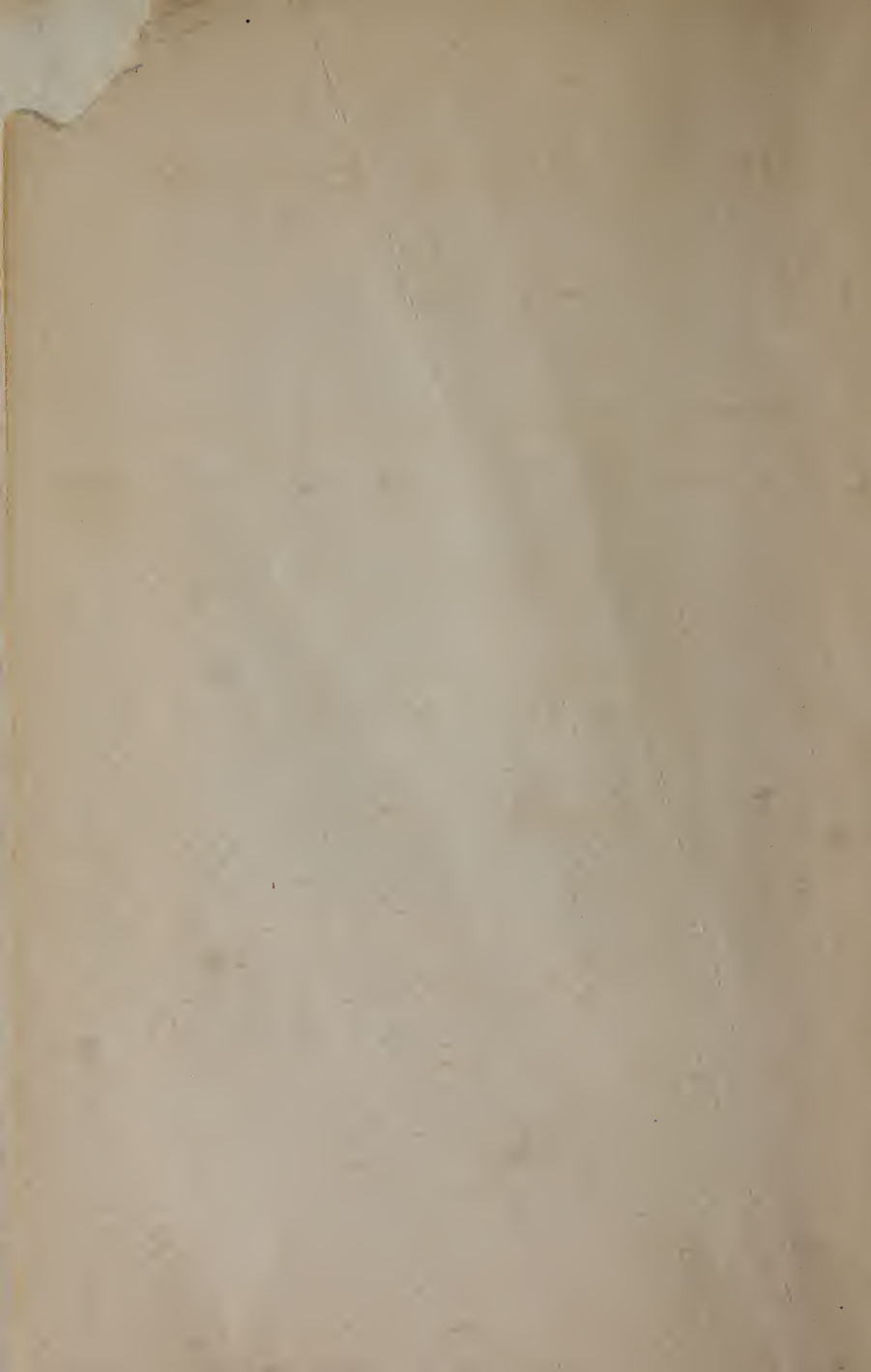


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Why ask for the moon
When we have the stars?



METAL PLATE PRINTING

A TREATISE ON

PRINTING IN THE LITHOGRAPHIC MANNER
FROM ZINC AND ALUMINUM PLATES

*Compiled, Edited and Elucidated in the
Office of The National Lithographer*

By

WARREN C. BROWNE

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Preface

THE constant and ever increasing demand for a text book dealing with the new process of printing in the lithographic manner from metal plates has resulted in the production of this volume. In it is covered every point from the preparing of the plates to the production of the printed sheet. It has been the intention of the writer to make the entire work as lucid as such a technical subject could be made, so that the young man in the business as well as the older ones could understand it.

In compiling this work the experience and knowledge of many expert workers in metal plate printing has been used, and the writer is under obligation to the many friends in the trade who have so ably and willingly given assistance and information in regard to technical points which were necessarily outside his own observation and experience. He has also had recourse to many books on lithography published in this and other countries and wherever it was possible to adapt foreign methods to the conditions in this country, those methods have been elucidated and will be found in this volume. Many of the very best parts of the book have been published in articles found in the columns of the *National Lithographer* issued during the past few years—since metal plate printing has taken a conspicuous place in lithography.

In offering this book to the trade the writer has no apologies to make. He believes that much good will come of its study, and especially recommends it to those lithographers who are contemplating a change from stone to metal as a printing surface.

WARREN C. BROWNE.

New York City, 1910.

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METAL PLATE PRINTING

How The Plates Should Be Prepared, Grained, Polished, Made Ready For Use, and Used

METAL plate, as a substitute for stone, is now such an important factor in lithography that the printer who is progressive and wishes to consider himself thoroughly efficient must possess a fairly comprehensive and practical knowledge of its manipulation and possibilities.

Every up-to-date lithographer knows that since the introduction of lithography, more than a hundred years ago, much time and many experiments have been made by those interested in the art to discover an efficient substitute for the Solenhofen stones. The great Senefelder himself was the first to look about for a less cumbersome material to work with, and this research has been continued up to the present time.

There have been many setbacks and disappointments, but by a system of elimination, after a century devoted to experimenting, the present day metal plate has been evolved, and there is no question about its permanency as a factor in lithography.

During the past century there have been many so-called perfect substitutes for the lithographic stones, and we have witnessed the failure of most of these new printing surfaces. These failures, however, have only spurred lithographic inventors to greater activity, and within the last few years great headway has been made in the effort to devise a method to supersede stone.

In this process of substitution we have heard a great deal about the qualities of zinc and aluminum plates, and we have seen a great amount of good work obtained from both. Rapid strides have been made in the manufacture, preparation and method of working these metal plates, so that we now have a printing surface which is equal to the best Bavarian stones, and that fact is becoming more apparent every day.

Although metal plates of one kind or another have been in the market for a great many years, there have been periods when they fell into disuse, one of the most objectionable features in the past being their dark color preventing the eye from distinguishing clearly the sharpness of the work. Chemical science tried many methods of coating, depositing, and crystallizing matter upon the surface of a plate in order to obtain a suitable printing surface, and latterly a plan to render the face of a plate more porous than ever before was evolved. The cheapness of zinc led chemists to inject into the outer surface of zinc plates a certain crystalline deposit, which in penetrating the outer crust of the metal left a white covering as a fixed part of the plate, which equals the brightness of aluminum. This treatment, it was found, prevented the usual oxidation, it opened up the porosity of the zinc,

to enable the transferred lines to enter deeper into its surface, and thus hold the work firmer. This increased porosity, at the same time, holds the moisture longer in the damping process, and altogether it has filled a long felt void in lithography.

Still, many lithographers have held to aluminum despite the difference in the cost, the bright, silvery color of its surface appealing strongly to them; this is especially true in England, where the advent of aluminum was hailed with delight by so many in the trade, and where they are slow to take up new processes.

If the inexperienced lithographer is wise and wants to save himself time, trouble and money, he will start in by procuring his plates from some dealer who makes a specialty of preparing them. There are some, however, who prefer purchasing the non-processed plates and grain-ing them to suit their own particular ways; but for the man who is just beginning metal plate printing, the most inexpensive way is to procure prepared plates, thereby obviating the trouble and cost of machinery and the possibility of errors which will be costly and very discouraging.

This book, the compilation of which includes various methods of metal plate printing, is intended for the small lithographic shop with the flat-bed press, as well as for the larger houses where the rotary and rubber offset press has been installed. While it is a fact which cannot be successfully refuted, that the offset press is revolutionizing the lithographic trade, it is likewise true that for many years to come the flat-bed and direct printing steam press will be in use, and to them the metal plate is rela-

tively of as much importance as it is to the establishments that use the offset process.

There has lately been put on the market for sale several kinds of metal plates, both prepared and unprepared, each claiming a superiority over the other. While it is not the province of the publisher of this book to advance the cause of any particular process, the assertion is ventured that a carefully prepared metal plate is far preferable to the raw plate, for reasons which will be set forth in detail later, and the statement is vouchsafed that metal plate printing has come to stay. Under this process the chemicals used in preparation are incorporated with the metal, so that transfers are put down not on any artificial surface, but on the metal itself. Directions for handling unprepared metal are also included in this work.

Information and directions given by various experts for transferring, preparing and printing are incorporated in this book, and if they are closely perused they will be found to be simple and valuable. Those who are in the trade ought to take every opportunity of studying this subject deeply and testing carefully the various plates which are available for printing purposes, always keeping in mind that the father of lithography was not satisfied with the parent method and spent much time in searching for a suitable substitute for stone.

The prejudice which has hitherto checked the progress of this branch of lithography was not altogether of an unreasonable character, in view of the fact that until recently the plates themselves were far from reliable and the difficulties resulting from them were a fruitful source of trouble and expense. Practical lithographers

were wont to look askance at every new device presented, and the many failures encountered caused them to adhere with determined loyalty to the original method, and cast aside as unworthy any and all substitutes.

Time has made many changes, however, and, while metal as a printing surface, is even yet a comparatively new factor in lithography, beautiful results have been given us by that medium, and it behooves every lithographer to make a close study of the newer process in metal plate printing.

Just as the human race has passed through its rude and crude stone age of the dim and distant past, on to the present vitalizing metallic epoch of mankind, so likewise has the craft of lithography traversed through its cumbrous quarry period of the unwieldy litho stone and wooden press, on to that of the modern, mighty, power-driven rotary and offset press of to-day, their printing surfaces of metal plates fast usurping the old-time stones.

It is no secret that zinc was the pioneer metal that ventured earliest into the competing field of the lithograph slab, and that it has at last securely established its vast importance in present day lithography. All this serves to prove that class will ultimately triumph, even though it has had to pass through many exasperating vicissitudes, and checkered experiences in its transit to the coveted goal; yet, that it has arrived to stay is being universally recognized and accepted.

It may not be amiss to hark back momentarily to one of those past reminiscences of a quarter century ago when our collective conception and practical knowledge of zinc as a printing surface in lithography was quite on dif-

ferent lines to that which prevails to-day. To that period when the unconquered troubles attendant upon zinc at that time fell upon the unlucky printer, "as fast and as thick as snowflakes in a blizzard"; and to when he was accustomed to breathe those terrifying curses, raked up from the greatest depths of his second nature, upon the perfidious metal, as he "bent his back and bowed his head" over the "wrecked" ink image which had so ruffled his temper, and blasted his confidence and reputation.

It is recalled how much merriment was caused by one witty Irishman travailing on some troublesome plate, when he confidently assured those near him that "he always commenced to curse zinc early in the morning as he was putting on his trousers, and that he never ceased execrating it during the day at his work, and continued the malediction in the leisure of his evening, as he blew the froth off his pot of ale"; he said its nature was so bad that it had to be spelt with a letter right deep down at the bottom of the alphabet.

This refers to the period when ponderous slabs of zinc were used, generally half an inch thick, and fully impregnated with impurities of other metals and dross; and when an effort was made to print them with an almost smooth surface, like what was customary with the long established litho stone.

The majority of litho printers have been working with the litho stone from their apprenticeship till the present day, and it is not surprising that in relation to the use of stone almost every possible contingency has been provided for, while with metal plates a little fresh knowledge must necessarily be acquired before the workman

can claim the same familiarity of manipulation which he may feel toward the parent process. This is, in fact, the point upon which the whole question usually turns. Good work can be produced from metal plates—of that there is not the slightest doubt—and it is equally certain that the advantages offered by their use are of a substantial and practical character. They can, in the first place, be handled with ease, and then again there is absolutely no fear of breaking them. In addition they are less expensive than stone and require less storage room.

A grain of a finer and sharper texture can be imparted to the metal than is the case with stone, and what is even of greater importance, the character of such a grain remains unaffected for a considerable time. Surface inequalities are rarely encountered in metal printing surfaces and consequently uniform pressure is to a certain extent guaranteed.

Although an unprepared metal plate, which has been carefully polished to free it from every trace of grease, can be used for lithographic printing, excellent results are obtained from the plates which have been specially prepared, and in many houses they are preferred to the plain plates. Many of these prepared plates are so satisfactory that half million runs have been made off one plate without deterioration, the last impression being equal to the first. Any lithographic printer of ordinary intelligence can, by following simple instructions, do any class of work successfully, whether on a flat-bed, rotary or offset press.

As these processed plates do not oxidize either from water or ink, and are all ready, without treatment, for the

artist or transferrer, it is needless to dilate upon them further.

As there are a few houses who prefer purchasing plain plates and treating them themselves, some methods dealing with this treatment are here given.



Preparing the Plates

WHILE the art of drawing on and printing from metal plates in a lithographic manner is by no means new, yet, as the percentage of lithographers having had success in the manipulation of this printing surface is small, we shall proceed to give some information appertaining to each section of the art, trusting that our text will prove of value to all those interested in lithography.

Of the many makes of metal plates on the market, each possesses distinct advantages for special lines of work. Some have a chemically prepared surface, others have a mechanically prepared surface, while a few are prepared electrolytically.

A slight de-polishing with pumice sand and a piece of felt may impart the requisite "tooth" to the face of the unprepared plate, or it may be cleaned with the pumice sand and felt and then immersed in a hot bath containing 36 ounces of water, $\frac{1}{2}$ -ounce of alum, and 2 drams of nitric acid. This liquid should be kept in constant motion over the face of the plate until it assumes an even, silvery-grey appearance, and then the plate should be washed thoroughly with a plentiful supply of clean water. It should then be dried quickly.

The plates are of various and numerous kinds, having either a grained or a smooth surface, and are made

in several gauges. The stock gauges are usually 25, 22, and 19, BWG, but other gauges can, of course, be made to meet all requirements.

For general work on the transfer press, it is customary to have a fine grained surface, and plates for rotary, flat-bed or offset machines must be a little coarser, so that they may be the better enabled to hold the moisture.

In Europe they have adopted what they call the "Continental Graining" method for treating metal plates and the larger lithographic firms in England have put it into use. This consists of a large-sized plate graining machine fitted with a very deep box recess into which is arranged a number of smaller graining boxes of a much shallower description, being just deep enough to allow each box to carry a plate, and the graining marbles, with just enough margin to spare for working purposes.

These smaller boxes are wedged in tight in tiers in the large box, one above the other, a dozen being worked at the same time, so that in the running of one plate graining machine, as many as a dozen plates are being prepared at one and the same time; an important consideration where a number of small litho machines, engaged on short runs, have to be kept going.

After the graining of the plates is properly completed, they are well washed back and front, to remove any adhering pumice paste or grains of the powder; they are then treated to an "alum acid bath," which renders them much more sensitive to grease, and also ensures their being made chemically clean.

This treatment is known as the "affinitising bath," because the function performed by it is to cause the plate

to have a greater affinity, or susceptibility to the greasy ink, after having been subjected to its influence in this bathing process.

To carry this operation out economically on a large scale, a huge upright glazed earthenware tank is employed, fitted with overhanging supports, from which the various plates may be suspended in the bath; or they may be inserted in niched grooves, which are also a separate fitment of this bath.

This bathing is done on a smaller scale by means of horizontal porcelain dishes; or in a more economical manner still by means of wooden troughs, pitch lined, or coated with acid-proof resist varnish, such as asphaltum, or a mixture of shellac and Brunswick Black varnishes. The constituents of this "affinitising" bath as used abroad are:

Nitric acid	6 fluid ounces
Powdered alum	$\frac{1}{2}$ pound
Water	1 gallon

The alum is best dissolved in warm water, as it is so slowly soluble in cold water.

The plate is immersed in this bath for a period of about 5 minutes. When it is first inserted in this solution, a dark gray deposit quickly forms on its surface; this is sponged off so as to enable the liquor of the bath to again obtain full access to the plate, when eventually it will assume a pleasing silver gray hue, which is both a nice color to work upon, and a true indication of the best condition which the plate should attain to fit it for the best service in lithography.

Many establishments, both at home and abroad, in using the plates that are not prepared, obtain a fine matt surface by graining the plate either by hand or with a graining machine, securing a medium or coarse deep grain which can hardly be seen by the naked eye.

The principle involved in the graining is the use of a very fine powder, harder than metal, moved cross-wise under a certain pressure which is produced by a weight. The surface is thus given scratches which differ in length, depth and number. The breadth and depth of these scratches depends upon the hardness of the graining material, the amount of pressure, on the shape and size of the graining particles, and on the shapes of substances used to produce the pressure. For machine graining the materials used are: First, the finest pumice powder which is the softest graining material; second, yellow sand as for stones, or flint sand numbers 2 and 4 of medium powder; third, emery in No. 000 and 0, which are very hard and grain well; and fourth, grit, which is the hardest and gives a coarse grain.

The weighing materials may be marbles of either wood, glass or earthenware, the diameter of which should be from $\frac{1}{2}$ in. to 3 in., or ordinary pebbles, which can easily be obtained from any river bed. These should not exceed 1 to 2 inches. The pieces of porcelain or rolls of potato shape, which have been introduced lately, of the same size as the stones, are preferable.

In order to communicate the rubbing motion to the graining material a graining mill is used consisting of a strong water-tight tray which rests on ball bearings, which is set shaking by an eccentric. The shaking mo-

tion causes a movement of the graining and weighing materials. For smaller size plates wooden frames are sometimes used.

When the graining is finished the plate must be removed carefully—and this is an important point, as if not properly carried out the surface will be scratched. While the machine is moving the weighing materials should be brushed away from one corner, and this firmly grasped by the hand and the plate slowly but evenly pulled out. It should be then well washed in running water, and dried as quickly as possible before a fire or with an electric fan.

To grain by hand the plate should be fastened to a flat board, a sufficient quantity of coarse sifted sand, with some water sprinkled over it, and a plain iron weight used, or a litho stone. Small circular strokes should be used for about fifteen or twenty minutes. It must then be washed, covered with fine sand of 120 to 150 mesh, plenty of water used, and a bundle of No. 3 steel wire used for graining. After about ten to twenty minutes, when the surface should show a matt white surface of regular grain, the plate should be again washed and dried with a clean cloth.

After the drawing is laid down on the plate the following etching solution is recommended: One part of ammonium silico-fluoride, one part ammonium nitrate, dissolved in gum water; this should be allowed to act for about two minutes. Instead of the above a mixture of one part ammonium biphosphate, one part ammonium nitrate, in gum water, may be used. These give a firm, homogeneous surface, which is completely insoluble in water.

Corrections can, however, be made with dilute hydrochloric acid.

Until recently the lithographic craft did not seem to contemplate the possibility of enlisting revolutionary methods of etching treatment as now evolved, wherein electrical action as well as chemical ones are generated, in the so-called etching operations, which afford the most perfect results. Then the plate would oxidize as readily after the etching operation as before it. Now that trouble has been almost entirely eliminated.

In order to better comprehend and apportion the relative conditions that prevail in these methods of modern lithography, we must first briefly allude to the underlying principles that dominate lithographic printing from stone; which will afford us the co-relative cue for the metal.

On stone we speedily recognize that two entirely different physical and chemical conditions have to be attained, and undisturbedly maintained on its surface, during the actual printing operations. The one is a fatty compound, produced and preserved by means of the grease laden ink of the design; here the fatty acids contained in the transfer inks, possessing a chemical affinity for the lime base, of which the stone is comprised, form with it a grease attracting and grease retaining allegiance, and consequently a water resisting one.

We have now to account for the other remaining plain portions of the stone surface; these also need definite chemical treatment; in this case with a free acid (nitric solution), which decomposes them, producing at the same time physical changes; first by making these

plain places of a "rough," "matt" and "granular" character; which condition not only serves the purposes of miniature reservoirs for the retention of the essential damping water, but also affords a "grip-hold" for the inking rollers, when passing over the stone; and this more effectually prevents them from skidding and sliding over the face of the work.

At the same time, the decomposition of these parts by the acid solution, has had the effect of raising the work slightly into relief.

But this is not all, as we have not yet obtained the full requisite chemical conditions, indispensable for these plain parts to acquire. This can only be done by what is known as the "gumming operation," in which we apply to them a syrupy solution of "gum arabic," this on its drying and oxidizing with these uninked portions of the stone, forms there that important and necessary compound known as "gummate of calcium;" a compound entirely different in character and condition to that possessed by the "fatty calcium compound;" being in fact the direct antithesis to it, and none the less ignorable.

Here, then, in the lithographic stone as a printing medium, we have a natural substance, upon which we can produce two contrary conditions: one whose natural attributes are an "affinity" or "liking for water" (which is supplied in the damping operations), and which affords those portions the "power to reject grease;" in the other we can create a "grease attracting," and "water rejecting" condition; both of these peculiar qualities being absolutely essential to "planographic," or "flat surface printing," as represented by the lithographic process.

If either of these two adverse conditions should be faulty, then perfect printing cannot be effected; as for example, assuming that the image has been perfectly drawn upon the stone, if the "lights" become soiled through an inefficient gummate, then the actual print itself becomes degraded.

Equally so then is the same resultant conditions vital in the metal printing process, or flat surface printing in the lithographic manner from zinc or aluminum plates.

Commencing first with zinc: here we find that this metal also possesses (like the litho stone) a strong affinity for fatty bodies; hence greasy transfer inks combine readily with it. In fact, it is even more sensitive and susceptible to grease, than the stone, so far as superficial relations are involved; but at the same time it does not inherit similar internal penetrative facilities as does the stone, on account of the difference existing in their respective parasites; specific gravities, and molecular structure; the stone, moreover, being a compound body, whilst the zinc is a simple elemental one.

Yet as we have before intimated, we endeavor to compensate for this in some degree, by applying a supplementary greasy body in a fluid form, in which state it is capable of a more piercing and penetrative action; so that in the end our grease compound on the zinc plate becomes as stably formed as the similar corresponding compound is established upon the stone, notwithstanding the difference in density that prevails in these two bodies.

This is one of the factors that has made for the modern triumph of zinc.

But equally important, and which long has proved to be the most difficult to attain on zinc, is the opposing state, that of the aqueous bearing portions, or gummate of the metal; where it is essential that those parts shall be "de-sensitized" to grease, so as to form and preserve the perfect "lights" of the image.

Instead of merely eating those parts slightly away by the agency of a corrosive acid, and leaving soluble compounds behind, as in the case of the old etching operations, we now, in the latest and most perfect methods, apply a solution, consisting of a mixture of various chemical compounds, which generate with the metal itself a voltaic action, which in, and through, this electrical influence, produces a new surface compound or layer, in direct chemical union with the zinc itself.

This new surface being the most perfect grease resisting medium yet devised or secured from a metal surface.

In short the whole of the plain zinc surface that has come in contact with this fluid has now become transferred from the simple metallic elemental state in which it originally existed, into that of a new compound body, possessing entirely different physical and chemical attributes, inasmuch as these parts of the zinc surface have now a predominant affinity and preference for water, and an absolute inability to hold grease when moisture is present and applied to them, in contradistinction to that state in which, immediately prior to this treatment, they had absolute preference and susceptibility for.

All this remarkable change being accomplished without any loss in the volume of the metal, even though the

so-called etching operation should have been prolonged inordinately.

Whereas in the old time method, when zinc was struggling for a place in lithography, a prolonged etching spelled ruin to the finer parts of the work, such as hair lines and delicate stipple, owing to the undercutting action of the acid creeping under the lines, and thus undermining the fine work.

It may further be affirmed that with the most perfect etching method, a more prolonged treatment with the etcher is often of an advantageous nature, especially when an excessively greasy quality and brand of ink is being used, as is sometimes the case; here the extra etching operation appears to carry the grease resistive properties to a lower strata of the metal, and thus render it much longer immune to grease encroachments, if the natural attrition of the plate during work should have thus impaired its original upper surface layer.

This taken in conjunction with the greater speed of the rotary machines, and the rubber offset presses, has advanced the cause for metal as a printing surface in lithography, not only to a par with the old time stone, but legions beyond it for productivity, security, economy and efficiency.

Aside from the proprietary processes protected by patents, it will no doubt prove of great interest to describe a few European methods for printing, lithographically, from metal, both zinc and aluminum.

Commencing with new, plain uncoated sheets of the best Silesian zinc, of the purest quality, plates of a thickness registering from 19 to 22 BWG are selected for

machine use, both flat-bed and rotary. These thicknesses of plate enable them to be bedded down to their supports perfectly taut and without buckling.

For the hand press, and for originals, thinner plates than these are employed, usually ones ranging from 29 to 25 BWG, are the gauge sizes usually used.

Although there are large deposits of zinc ore located in the Mendip Hills in Somersetshire, England, where it has long been extensively mined, yet despite that, a large part of the zinc plates of lithographic commerce, for use in the British Isles, are purchased chiefly from Continental sources, Siberia and Belgium, and some from the United States; the overwhelming preponderance of them, however, come from Siberia. These plates are ordinarily procured through the regular supply houses, and are then generally bought surface grained, ready for immediate use. There are some firms, however, who obtain them in the bare, unprepared state as sent out from the mill, with the hard, scaly, outer skin of the metal still adhering to them; as produced in the rigid rolling operations of manufacture. In this case additional tasks are imposed upon the lithographer, who has to first see to the removal of this outer "skin," and to selecting the best face of the plate for the printing surface proper.

It has been found from experience, that one face of the plate is purer and freer from defects than the other. This is due in large measure to tiny specks of iron being taken up during the heated manufacturing process, in which, due to the specific gravity of these two metals being different, the zinc being the heaviest, will fall to the bottom, while the lighter metal will remain on the top.

If, therefore, the new plate is first tested on both sides, the best face is easily detected, and at once reserved for the printing surface. This is done by mixing one part of commercial nitric acid with ten parts of water, and then applying some of this over a part of each face of the plate, either by means of a sponge or a pad of cotton wool.

If as a result of this treatment one side reveals a number of small, black specks and streaks, or dark circle markings, this will be the inferior side of the plate, and should be destined to always form the under side for working; the other side of course, being the one selected for the actual printing surface.

This chosen surface is then lightly polished over with a flat, smooth block of "Snake Stone" (water of Ayr stone), in order to remove any dross or shell.

Then next the extreme clamp edges of the plate, both "gripper" and "rear", are bent right over in a lap to the extent of about a quarter of an inch, so as to form a thicker wedge-like edge, which serves as an additional grip hold for the clamps on the plate when backing-up, and which is consequently a double security against them slipping, or "dragging out," during both "tightening up," and printing operations.

The correct bend of the gripper edges of the plate is next made, some establishments using a special "vise mould" for this purpose, while others simply fix one of the plate edges in the grip-bars of a plate bed, and then by means of a long, smooth batten of wood, laid in contact with this edge of the plate which is then struck a smart blow with a

wooden mallet, at the same time as the zinc plate is being bent down bodily to the plate bed.

This plate-grip bend when once formed, need never be straightened out again, if proper provision is made for its protection, as the repeated bending and restraighening of this defect soon causes the metal in this part to crack and break away, which then necessitates the plate being cut down for a smaller size.

Some few old fashioned firms, however, may still be found, who adhere to this injurious practice of re-bending the grip-edges of the plate each time they have to re-grain and re-transfer upon them for fresh jobs.

The general run of firms, however, provide bevel edged wood supports in the bed of the graining machine, and also bevel edged iron plates for the transferring presses; so that once the plate is bent at the clamp edges to suit either the flat bed machine or the rotary there is no need to resort to the re-straightening, or flattening out process again each time a plate is re-used for a fresh job, as everything is adapted to suit the requirements of the clamp curve during all the necessary phases of manipulation, contingent upon the preparation of a plate.

Now, as to the graining of the plate, lithographers using metal soon learn the exceeding importance of this branch of the business, as, if a plate is grained too feebly, then it has not the capacity to retain much moisture upon the surface, and consequently will sooner soil with the printing ink; this condition also necessitates a larger volume of damping water being applied to maintain the purity of the lights; this nat-

urally reacts upon the brilliance of the ink, dulling it and overloading it with moisture, which reflects itself in the greyness of the print. On the other hand, the transferrer favors a fine, delicate grain, because it is easier to roll up the work, as well as to run it down firm and solid, than if the grain of the plate was more "rasping" and "keen."

This perversity of conditions frequently prompts a slight clashing of interests between the transferring end of the business, and the machine room end.

The machine man unhesitatingly urges the more decided graining of the plate, so that the tiny excavations of the grain will form a more perfect reservoir for the retention of the damping water during printing. While the transferrer is partial to the more delicate graining of the plate, so that the fine lines of his transfer and his solids will be brought under more uniform and accommodating conditions; thus enabling him to send forward an irreproachable transfer with smart expedition.

The most common graining material in use in Europe is a medium texture pumice powder. This serves for the general run of work. For producing a coarser grain for poster work, flint sand and coarse glass powder are both used. Whilst emery powder, fine glass powder and carborundum powder are each employed for other range and classes of work.

For map printing, the plates are sometimes grained with the sand blast, in which fine Belgian sand is used for the graining.

Hitherto wooden balls were generally employed with the graining machines, but now they are being rapidly displaced by the porcelain balls, which are heavier, cheaper and wear better ; not being so prone to form flat sides on them, as is the custom with the maple-wood marbles.

Another good feature in connection with them is, that they do not adhere together in small clusters, as the wooden balls do when flats have been worn upon them, as the porcelain marbles wear down in a rotund manner, instead of angular, which is the drawback with the wooden marbles.

The English have a method of graining the plate with dry powder only using no water whatever, during graining operations. This plan, however, takes a little longer time to attain the desired granular matt effect of the plate surface, yet the grain so attained is preferred by some.

Whichever method is adopted, the grain can be slightly subdued, if the transferrer in his judgment considers it too crisp ; this is done by going all over the plate with a felt covered block and some finer pumice powder, by supplementary hand method for two or three minutes, but to leave the grain as produced by the machine is preferred by most well established houses, although some transferrers consider the plate is not complete till it receives this finishing touch by hand.

In the purchasing of non-processed plates, it is often advised to obtain the largest sizes, and cut the sheets down to suit the work in hand. To prevent the

plates from being bent or cockled, great care should be exercised in cutting them down. They must be kept perfectly flat, as any unevenness of surface is sure to interfere with their successful working.

There are several very good methods of shortening, or cutting down, the plates. An ordinary book-binder's card-cutting machine is very useful for this purpose, as it allows the plate to lie perfectly flat and be held securely. If this cannot be obtained, or is not preferred, a fine, well sharpened saw will answer the purpose. After the plate is cut the burr must be removed from the edges with a file and the corners can be snipped or rounded off. When a new batch of plates is delivered, they should first be submitted to a thorough examination before putting into use. If this examination is properly carried out, much time and trouble will be saved in the future.

The plates, when delivered to the printer, generally have a perfectly even surface of a dull, silvery color, and are free from all marks and blemishes. A serious obstacle to perfect work is the presence of oxide on some of the metal plates. This sometimes appears on the surface of the plates in the form of white powder, and which can be detected by rubbing the plate with cloth. When plates are discovered to have an excess of oxide on the surface, or when they are stained, they should be returned immediately to the manufacturer as defective.

After the plates have been selected for use, those not immediately required are usually wrapped carefully in clean paper and stored in a dry closet or the vault of a safe, or some similar receptacle.

There is an excellent method adopted by some establishments upon receipt of new plates which is worth mentioning. Immediately upon their arrival, they are unpacked to prevent oxidation owing to changes in the temperature. They are then laid out singly and, when they have assumed the temperature of the room, the prepared side of the plate is rubbed over with French chalk, and each plate is then wrapped carefully and separately, in clean, dry paper, and laid away in a dry place until required for use.

By this same method, when the time arrives for the design to be made upon the plate, the prepared side is wiped with a wet cloth to remove the French chalk, and then dried with a clean cloth that has been charged with a small quantity of oil of turpentine, the prepared surface is briskly rubbed to remove all traces of grease and finger-marks. It is again rubbed with another cloth charged with a small quantity of benzine.

This cleaning is followed by laying the plate face upwards in a large shallow earthenware dish, such as used by photographers, and flowing over it a solution consisting of one quart of either rain or distilled water, to one pound of citric acid of pure crystals. The bath must be kept in motion, and the surface of the plate must be rubbed frequently with a pad of raw cotton, by which means the dissolved metal and impurities are removed. After remaining in this solution for three or four minutes, the plate should present a dull, even surface, but if stains appear it must again be bathed in the acid solution until they have been removed.

When the plate has been treated in this manner to the satisfaction of the printer, it is thoroughly washed with clean water and rubbed with a cloth to remove any trace of acid that may remain. In following this formula it is well to give the plate a final rinse with water and dry it rapidly to prevent further oxidizing. The plate is then clean, and in condition for the artist or printer.

The foregoing may seem to be a somewhat elaborate method of cleansing, but it is a simple process if systematically carried out, and is sure to repay the extra time spent upon it. The trouble caused by greasy patches, which sometimes make their appearance when rolling up a plate, is entirely removed when this preliminary cleaning is carried through. Likewise the difficulty occasionally experienced in endeavoring to make a design hold firmly to a plate that has had a slightly oxidized surface, is entirely avoided. The trouble caused by oxide is of frequent occurrence in the workshop, and one that is not sufficiently understood by the members of the craft. If it was the quality of the impressions obtained would be considerably improved.

An important point is to have clean materials to work with. The various cloths and sponges used should be periodically washed in boiling water, and when not in use should be kept separate for their various special uses. In every branch of lithography it is essential to have clean surroundings, but nowhere do we find it more so than in the manipulation of metal plates; in fact, the secret of the whole process seems to be wrapped up in the one word—Cleanliness.

The art of drawing upon metal differs but little from the method of working upon stone, and it is only necessary to make a few general remarks upon this important branch of lithography.



Engraving on Metal Plates

AFTER the metal plate has been prepared and passed into the artists' department, the first duty of the artist upon receipt of the plate is to examine it carefully to test its suitability for the work in hand. If any blemishes are present, the artist should have them eliminated. He should be careful at all times in handling the plates, and so avoid the trouble caused by the rolling up of finger marks. Thoroughly clean plates are very sensitive and consequently should be handled with the greatest care. An excellent plan in use by some artists, is to obtain a sheet of paper the exact size of the plate; a rough outline is made of the size of the work to be drawn. This is then cut away, and the remainder of the sheet is gummed onto the face of the metal. When in position, the outer margins of the plate, that are not to receive the work, are fully protected, and the plate can be handled with much freedom, so that it amply repays for the little time spent upon it in making and fixing the mask.

The next thing to consider is the most suitable surface to lay the plate upon. Perhaps the most convenient and suitable table for the artist to use is an ordinary lithographic stone. One that is slightly roughened will be best, as it will prevent the plate from

slipping about while being drawn upon. Another advantage to be gained from using a stone is that in cold weather the stone can be occasionally warmed which will assist the flow of ink, and make the crayon work more freely than it otherwise would.

The ink used should be a little stronger than for stone work. All solids should be filled in as full as possible, and should present a good black appearance.

If the plate is a grained one, the outlines and solid parts of the design should first be filled in, which will give a better idea of the amount of tone required. Care should be taken that the gumming-out solution is not applied too thickly to those parts nearest to the rubbed-in tints: the reason is obvious.

We may here mention that, should the artist have had no previous experience with metal it would be advisable to obtain a small grained plate and try the effect of his various chinks before proceeding with the work in hand. In this manner he will become familiar with the varieties of grain obtained, as well as the power of the materials he is in the habit of using.

For chalk drawings it is advisable to use the harder crayons instead of the soft. The latter should only be used on the heavy parts of the design.

Scoring and scraping of the plate should be entirely avoided, because such lines or scratches are left with a burr on their edges, which take the ink and gradually fill in as the printing is proceeded with.

When the drawing is completed to the satisfaction of the artist, it must be thoroughly dusted with French chalk, well rubbed in, and the work is ready for etching.

The important operation of etching an original drawing is one that is best executed by the artist who produced it. He has the best knowledge of the quality of the work upon the plate, and understands which parts should receive the weaker and which the stronger etching. He also avoids the possibility of the design becoming injured by a workman who may have scant knowledge of the work in hand.

The acid solution to be used for this purpose is somewhat different from that for the stone. A good solution consists of:

Nut-gall solution.....	10 ozs.
Gum arabic solution (thickness of cream).....	20 ozs.
Phosphoric acid.....	$\frac{1}{4}$ oz.
Nitric acid.....	$\frac{1}{2}$ oz.

The strength of this acid should be altered to suit the work on the plate. If the design consists of many fine lines and stipples, add more gum solution. If it is required stronger, add phosphoric acid. The nut-gall solution can be made in the following manner: Three ounces of nut-galls are steeped in one quart of water for twenty-four hours. They are then boiled until soft, when they are crushed and strained through a piece of muslin. A few drops of carbolic acid should be added to prevent the formation of mold.

The etching of the design is accomplished as follows: Lay the plate upon a sheet of clean paper a few inches larger than the plate. Pour a quantity of the etching solution into a flat dish, take a broad camel-hair etching brush, and dip into the solution and coat the plate evenly.

First cover the plate evenly, moving the brush from left to right, and then from top to the bottom. When this has been properly accomplished, the plate should have an even covering of gum and acid upon its surface. It can be more evenly distributed by rubbing with the open hand, which entirely removes any streaks that sometimes occur when a brush is used.

Another method of etching that is recommended for high-class work is to place the plate in a flat, shallow dish and allow the etching solution to flow over its surface. By this means the danger is entirely avoided of injuring the drawing by the mechanical application of etching solution. When, in the opinion of the artist, the plate has been sufficiently etched, it must be stood up on edge and allowed to dry. The drying can be assisted by fanning the surface, but heat must not be used, or complications are likely to arise owing to the ink spreading or the gum drying too hard.

When the etching solution has thoroughly dried, the plate is in a fit condition to be handed over to the transferrer for rolling up and proving.

It is well to repeat that almost every description of lithography can be executed from metal plates. The quality of the work obtained depends not so much upon the quality of the metal used as upon the care of the artist and printer through whose hands it passes.

Before going into further details of the metal plate process, it might be well to again point out to the printers who wish to be up to the times, the chief advantage to be derived from having a knowledge of this system. The fact that there is money in it is at once apparent,

and, as experience of lithographic management has proved, the versatile craftsman knows his value in the workshop, while on the other hand, we have yet to find the employer who is not ready to appreciate, in a substantial manner, the superior all-around skill and knowledge of any workman who may be in his service. It is, therefore, of the utmost importance to all lithographers who have the interest of their trade at heart to study carefully the several methods and many little wrinkles for successfully working metal plates set forth in this volume.

In Germany, where unprepared metal plates are used to a large extent, the plate is first cleaned with saltpetre lye, after which it is polished with pumice powder and rubbed with felt in cross-forming movements. Then a solution of acetic acid and water is poured upon the plate. Sometimes a black surface appears and this should be rubbed with flannel, if this method is tried. It is also well to rub the plate with the acetic acid solution regularly and lightly until it receives a whitish-gray appearance. Citric acid is sometimes used for this purpose. The plate, now of a smoke color, is ready to receive the transfer and particular attention should be taken to prevent fingermarks, etc. After the placing of the transfer, the plate must be freed from all uncleanness by the liberal use of clear water, and afterwards gummed with thin gum arabic. Here, too, the greatest caution is necessary, because, after the drying of the gum, the plate "over the gum" is to be cleaned with washing off tincture, and then rolled up with one-third transfer ink and two-thirds pen ink. When the plate is blacked equally it is for the

first time wiped with water, whereby the gum dissolves and the drawing, well-covered and sharp, remains. The printing plate so obtained should be carefully powdered with talc and colophony, or rosin, and etched for the first time. The etching must be performed with the greatest judgment and for this several minutes of time is required.

To secure a good etching, two stock solutions must be made; first, a thick gum arabic solution, which must be strained through fine gauze, by which means all impurities are cleared off; second, a cold saturated alum solution must be made, in which so much alum is dissolved that it leaves a surplus at the bottom of the bottle. Sulphuric acid clay may also be used for this purpose. Seventy-five parts of gum and twenty-five parts of alum solution are well mixed, and 3 to 5 parts of nitric acid are added to it. This mixture is left to stand for some hours and then it is fit for use.

The etching is performed as follows: The plate is flowed over with the above described etching solution and left to act for from three to five minutes. During this time it is well to regulate it over the plate with a sponge or soft brush, without rubbing hard. Meantime stains and such things must be removed with the corrector's hone or a piece of charcoal. After this the superfluous acid is removed, but this must not be poured back into the stock bottle—it must be thrown away. The plate has now, on the parts where there is no drawing, a whitish gray coat, which possesses a water attracting surface, and is, after repeatedly well gumming, fit for printing.

If this surface should begin to tone, it can, after the

first inking, be etched again in the same way, whereby the difficulty will disappear.

It may be remembered here that the acid mixture must not be used strongly, as too much acid forms a coating, which would leave the plate blank. If the etching solution, after the time given, has not formed a suitable surface, it is very easy to prove by scraping with a broad needle; then the etching solution must be used weaker. Corrections may be very easily made by this method: either polish with felt or pumice powder or acidulate with thin vinegar or sulphuric acid, or lightly scratch it with scraper or needle, only be careful that these parts are etched according to the rules given.

Oxidation of the plates is excluded by this method, and they may be preserved for years without in the least degree deteriorating. A favorite method of engraving on metal plates which have been prepared is to well etch the surface, gum up and dry and then wash off thoroughly. Then coat thinly with an asphaltum resist composition of 1 part yellow beeswax to 5 parts Syrian asphaltum and melt together in a bowl, after which Benzoll or Spirits of Turpentine is evenly spread over the plate with a broad camel-hair brush. The operation of coating should take place as quickly as possible in a room free from dust. Any detached hairs left from the brush after the coating must be removed. To give the coating a dark color, the plate is gently warmed and then held over a candle so that the smoke will mix with the asphaltum film which has become soft, and penetrate through the application of heat. An almost even black appearance will result, which

will permit the engraver to see his work more clearly as it progresses.

When the plate is cool the drawing or image is traced on this blackened surface with "set-off" paper. It is then engraved by means of needles of different thickness, after the points have been slightly rounded off on glass. It is not necessary that the needles should actually cut into the metal, as it is sufficient if the coating be just removed, and the metal bared in the places where the lines are made. It is, however, preferable that the needles should just touch the plate, or faintly scratch its surface, rather than that the asphaltum should not be removed by the needle. When the whole of the design is completed, any accidental incisions or scratches should be covered with asphaltum solution, and when this has dried the plate is treated with an acid bath. The engraving may now be inked in by means of a dauber and printed from in the same way as stone engravings, or in order to be able to use an ordinary nap roller for inking in and to print direct from the plate the following procedure may be adopted: First, ink in by means of a dauber with good black ink, dust in with fine resin powder, chalk with French chalk, then heat the plate to cause the resin powder to fuse, and finally etch the plate with a special high etching solution. This solution is applied for a few minutes until the deepest parts become sufficiently flat to be inked in with a nap roller.

If so desired the etching of the plate may be carried out in tone-stages, first etching for the finest parts, from about a half to two minutes, according to the grade of the lines, and the tone values of image; then stopping

out these finest parts with the asphaltum resist composition, and pursuing the etching for the next grade of tone, repeating this procedure until all the gradations are produced. This tone etching may also be done without the stopping out operation by conducting the etching of the various gradations with a brush as with etching machine engravings on stone.

Commercial designing is a trade of its own and while learning his trade the commercial engraver is usually not instructed in designing, but later, when working in a smaller litho establishment he is often required to make his own sketches, it being taken as a matter of course that he ought to know.

Now for the benefit of these workers it is suggested that the first and most important point for satisfactory wash sketches is the sketchboard.

This should be a rough surface (kid finish) bristol board. If for some reason the rough surface kind should not be on hand, take a smooth surface bristol, hold it under the hydrant and let the water run freely over both sides of the paper for a few minutes. When dry it will be ready for sketching.

The wash fluid should consist of: rubbed India ink, adding a little prussian blue or dark green, and some gamboge—this should be a pretty strong tint—then take some of the mixture in another saucer, adding a few drops of water, making a lighter tint of the same color, for the lighter shades.

After the layout is made with an "H" pencil, the black or solid work is done first, with waterproof ink. The open lettering and other fine lines required to appear on

the sketch to be outlined with the darker wash fluid, using a fine pen.

After this, thoroughly clean the sheet with a soft rubber, taking off all the pencil and other marks.

When washing the cloud effect, or background in the design, apply the lighter wash fluid where the tint is to be strongest, then dip the brush in clean water (just a little) and work the tint towards the lighter points. Another brush with nothing but clean water, should be used for the extreme ends and lightest parts. Shading of lettering to be put in last, with the darker fluid.

In designing script, the top and bottom guide-lines, and the general layout, should be drawn with a well-sharpened "HB." or "H." pencil, then go over the lettering with a "5 H." pencil, using some pressure in doing so, after this, clean the sheet with a soft rubber, which will take everything off the sketch except the sharp lines made with the "5 H." pencil. Cut in the body lines with rubber India ink.

This process will be found very simple and satisfactory to the man with limited experience, and might prove beneficial to the older craftsmen.

While metal plates are prepared to receive transfers or drawings in numerous ways, some of the prepared plates do not require any treatment at all before drawing or transferring except to be wiped off with a piece of clean cheese cloth to eliminate dust from the surface; where the surface is not so prepared they may be treated by any one of a dozen means. They may be first polished, for instance, with pumice and try-stone. In the graining process, to obtain a matt surface it is well to use pumice,

emery and glass-powder, much the same way as stones are made ready, or they may receive a fine grain, or "tooth," by means of an acid bath as previously set forth. The sand blast, which gives a fine granulated surface not unlike a very fine grained stone, is the favorite method in Germany. After the plates have been thus treated they should be immersed in a bath of alum, water and nitric acid as before mentioned. After the acid bath they must be thoroughly washed with clean water and promptly dried. A stoneware or enamelled trough is required for the bath and it is better, and more economical in the end, if the backs of the plates are protected with an acid resist, such as a coating of asphaltum.

In roughening the surface of the plate after the bath a favorite method among those who have adopted metal, is to place a plate on a perfectly flat, thick wooden board or on a litho stone, with a sheet of damp felt underneath to prevent movement. It is then damped and pumice powder sifted over it. A wooden block covered with a piece of close felt or flannel is then used as a grainer, the operator bearing heavily upon it and moving it continuously with a circular motion over every part of the plate. When the powder, in working, assumes a black slimy condition it should be washed off with water from a tap or through an India-rubber tube and fresh powder sifted over the plate. It will take about forty minutes and three or four renewals of powder to properly roughen a 25x38 inch plate. When the roughening is completed and the plate thoroughly washed, the water may be removed by means of a "squeegee," the plate will now dry

quickly and should have a beautiful, dull silver-like appearance, and is ready for use.

To obtain a more decided grain for chalk drawing a different treatment, owing to the difficulty in graining the metal is required. This treatment consists of the plate being fastened in a wooden tray and a large number of smaller or larger glass balls, with finer or coarser sand according to the quality of grain required, along with a supply of water, being moved about on the surface of the plate by means of a rocking motion given to the tray containing the plate and balls. A special apparatus for this purpose is supplied by the proprietors of the various metal plate processes.

Drawing on metal plates is done exactly as on stone, with pen or brush and liquid ink on the ordinary plates, or with chalk on plates grained for the purpose. A soft lead pencil, B or BB, may be used for sketching or outlining on the plate, or charcoal if the subject is a large one. For tracing red chalked paper is the safest and most useful. Oily tracing paper must be carefully avoided. It is necessary not to attempt to pick or scrape the plate for alteration. Anything drawn wrong will be better left alone and altered after the plate has been rolled up and prepared. The work requiring to be altered may then be easily deleted and the part resensitized for again drawing upon. Metal plates, being very sensitive to grease, great care must be exercised by the artist when working upon them.

Preserving the Plates

BEFORE outlining more fully the various recipes and methods in vogue in the preparatory work, it might be well to state in passing that the preservation of plates, after they have been received in the shop, is of vast importance. The storing away of plates—and for that matter the same applies to stone—without proper precautions for preventing deterioration, is harmful in the extreme. It is, in fact, by no means rare, when some future printer comes to utilize these reserve plates, to find that they present many serious difficulties to the execution of good work, solely through the want of the most ordinary precautions.

Possibly the design has become weak and only takes the ink with difficulty, and the delicate parts do not print sufficiently dark. The printer may try all he knows to impart new vigor to the work, only to find that his efforts accentuate the defects and blacken the surface of the plate or stone, which thereby loses its tonality.

If the metal plates bear designs full of little elevated points and hollows which become unduly prominent in working—thus destroying all harmony of design and giving the impressions a disagreeable appearance—it is easy, when they appear in the white spaces, to remove these points by the aid of a scraper. It is not so easy, however,

when they show in the design, for if the impression which appears is a little sensitive, the scraping accentuates them, and the retouching which is subsequently made becomes useless for careful work.

Such accidents are generally due to the effect of the atmospheric conditions of the storeroom the plates are kept in. These places, it must be said, are often the most unsanitary or out-of-the-way parts of the workshop. Often the storeroom for stones or plates is near to some damp place, the emanation from which softens and destroys the coating of gum; or the gum becomes acid and gradually destroys the plate left exposed without defence to the pernicious effects of damp air saturated with evil vapors. The compositions turn sour, and very soon the work of destruction is accomplished. It is mostly in small offices that we find these infectious influences. There stones and plates are heaped together promiscuously, and sacrificed in advance to almost certain deterioration. The only excuse is the want of space. It is easily possible to render stones insensible to humidity, but the metal plates should, by all means, be kept in a dry place. To render the plates damp proof, as far as possible, when the job is worked off, they should be gummed up with a cold solution of gum arabic to which some bichromate of potash has been added.

The coating given ought to be very regular, thin, and very rapidly applied. When it is dry the plate should be exposed to light for half to three-quarters of an hour. This produces a combination of the gum with the chromic acid. The coating becomes invulnerable to damp, and the plate is protected against all oxidation. After having

been exposed, the plate is gummed afresh with ordinary gum, being careful that it is not sour, which would oxidize the plate.

When it is required to use the plate after being in store for any time, it is sufficient to wash it with water to which 1 to 2 per cent. of phosphoric acid has been added. The coat of bichromatized gum is rapidly dissolved, and the plate is then ready for printing. In order to preserve the work on metal plates when they are to be stored away for a considerable time, the following method has found favor in many houses:

The printing ink should be washed off the plate, and the job must then be rolled up in a non-drying preservative ink which will not oxidize on contact with the atmosphere. This ink is generally compounded by the printer himself, and sufficient quantity mixed up to be kept in stock, so as to last for a considerable time. It is prepared as follows:

Spermaceti	4 oz.
Beeswax	6 oz.
Good Black Litho. Ink.....	4 oz.
Olive Oil	1 fluid oz.
Glycerine	$\frac{1}{2}$ oz.

The wax and spermaceti should be melted first, then the ink added in small quantities till dissolved, and the oil well incorporated. Tallow may be used in place of the spermaceti if desired, but the latter is the best. A special nap roller should be kept for this ink, and all jobs on plates that have to stand a long time should be rolled in with this ink before putting away. There will then be no danger or trouble in washing out when required again.

If necessary, the ink can be softened still more by the addition of a few drops of turps before applying to the roller.

Another and more simple way is to gum the plate up with thin gum which is rubbed very smooth and fanned dry. Then wash out with an asphaltum solution composed of asphaltum, beeswax, tallow and turpentine, which can be purchased from almost any supply house which deals in metal plates, at a reasonable price. This method is much more simple, as it requires no rolling up and has been used successfully in some quarters.



Zinc and Aluminum

AN English authority, discussing the relative merits of aluminum and zinc plates, after admitting that the printing from both is closely associated, declares aluminum to be superior.

Aluminum, this authority asserts, possesses some decided differences in character which call for special attention, both in preparing the work and printing the same. It possesses several advantages over zinc and, keeping to the same comparison, has no disadvantages. These advantages are pointed out as follows:

1. It is a beautiful white metal, and shows very clearly the work drawn or transferred upon it, and is therefore more agreeable to work with.

2. It is extremely light, its specific gravity being about 2.5, while zinc is about 6.9, showing that it is not far short of being only one-third the weight of zinc.

3. It is very ductile, and though this does not count for much in comparison with zinc, which is also ductile, it is yet a favorable quality when taken into consideration with its lightness and weight.

4. It is not affected by nitric or sulphuric acid, neither will it tarnish or corrode by exposure to damp or impure air; this latter quality is a valuable one in storing plates for future use. It is acted upon more or less actively by

hydrofluoric, hydrochloric and phosphoric acid, and also by strong alkalies.

5. It possesses a more porous nature than zinc, being in this respect nearer the litho. stone than any other metal we are acquainted with.

The metal, which was previously very scarce and expensive, has in recent years been produced on a commercial scale, being now obtained in large quantity by means of electricity from a certain mineral or clay called Bauxite. Aluminum was found to possess so many good qualities that it was soon experimented with as a printing medium by a German lithographer, whose experiments were in a large measure successful. After further careful experimenting by German lithographic establishments, the process assumed more definite shape, and patent rights were obtained in various countries for working it.

In America also, aluminum plates were, at an early stage, experimented with as a substitute for stone, and are now used for printing many classes of work.

The process became known and was introduced to the printing trade in England under the name of "Algraphy," which is now its distinctive title in England.

In the United States at the present time, there are a number of factories where both aluminum and zinc plates are being manufactured and the demand for the output is very large, and growing all the time. It is a fact that cannot be denied successfully, however, that the zinc plate has met with greater favor than the aluminum.

British ingenuity discovered that the ductility of aluminum made it very suitable for forming into plates, and these plates possessing a semi-porous nature lent

themselves in no ordinary degree to the requirements of the lithographic basis of printing, viz., the mutual repulsion of grease and water. This porosity is further assisted as the means of retaining moisture by having the plates prepared with a fine granular surface. This fine grain or "tooth" gives a very suitable surface for printing, and permits of the rollers taking kindly to the plate when passing over it.

There are various solutions necessary for the proper working of aluminum plates. They are happily not of a complex nature, but at the same time it is imperative that they should be carefully attended to if successful printing from these plates is to be obtained. Further, it is only reasonable to expect that those who have had experience in the process since its inception and have passed through all the experimental stages of its progress should be able to give the best possible means to attain the desired end. While it is true that a few years ago, aluminum appeared to be far superior to zinc, it must be remembered that more recent improvements in the latter metal have resulted in the production of a zinc plate that is almost pure, which does not now contain the non-porous surface formerly complained of, and prepared zinc plates are now being made and sold wherever the lithographic art is practiced.

Alterations

ALTERATIONS, whether on stone or metal, are always troublesome and are not uniformly successful. An authority on alterations has this to say about that feature of the work:

The work should be rolled up with a strong black ink and dusted over with French chalk (talc). Remove the part which requires altering with a mixture of half etching solution and half turpentine on a small, clean piece of flannel and rinse well with water, then apply a solution which consists of a strong alkaline to destroy the grease. Care should be taken not to touch the remaining work, as this solution would destroy it. The alkaline solution is gently rubbed with a small piece of felt or flannel in all directions for one or two minutes over the part where the old work has been removed, and then well rinsed with water. Then pour a few drops of solution on a small piece of sponge and rub over the part which should receive the alteration and again rinse with plenty of water. This operation should be repeated two or three times to secure success. Now the plate is dried; then a few drops of coating solution is poured on the plate and brushed with a soft, clean nail brush till the coating is thoroughly dry, when the prepared part of the plate is ready to be drawn upon.

The one thing needful in order that alterations may be satisfactorily made, is to have the plate perfectly free from grease, gum and dirt ; in short, to have a chemically clean or sensitive surface, such as existed when it came from the makers.

After this the plate is washed thoroughly on both sides with a copious supply of perfectly clean water, taking care that no scum of the bath remains upon its surface ; it is then rapidly dried, either over a heater, or in a hot air chamber to prevent streak markings, or oxidation through slow, faulty drying in a cold atmosphere. The plate is then ready for either the litho. transferrer, artist, or engraver.

The chief merits of metal plate printing, whether from zinc or aluminum, prepared, or unprepared plates, are economy, speed, simplicity and efficiency, and we are confident that such merits will appeal to all lithographic establishments desirous of progress.



Transferring on Metal Plates

THE operation of transferring work to metal plates, whether of zinc or aluminum, is almost the same as that for stone. As a general rule the plates, being thin, require for convenience in working, to be placed on a stone with a wet sheet of paper underneath to prevent slipping, although there are other methods which will be dealt with later. As a set rule, it is not advisable to heat the plates; if any heat should be required, however, for some special work the stone may be slightly warmed, which will answer every purpose. The work is then damped and transferred in the usual way. These plate transfers should be passed through on sheets of paper twice, as a general rule, to remove all superfluous ink. It is a good thing, and should invariably be carried out, to pass all plate transfers through the litho. press, face down, on a sheet of smooth printing paper, afterwards heating them off before a fire.

While the general method of lithographing from metal plates is somewhat similar to that used in printing from stone, there is enough difference to puzzle some very clever lithographers, and those who are about to adopt the new process will find the suggestions and rules laid down here to be of considerable importance. While there is no absolute rule laid down for using metal plates,

the reader will find that he will be able to accomplish more easily and successfully that which he sets out to do if he follows these suggestions. The fact that the offset process of lithographing calls for the use of plates instead of stone, and that hundreds of establishments have recently adopted the offset press makes a knowledge of metal plate printing more desirable just now than at any other period.

After the transfer has been made and the starch has been removed from the plate, the American lithographer covers the surface of the plate with strong gum and this is rubbed up while the plate is still wet. It is then washed out with an asphaltum solution on the dry gum. This solution is generally of a very greasy nature else the work will not roll up solid. After it is washed out with the asphaltum solution, it is then washed off with water and rolled up. When the work has become fully charged with ink it is dusted with resin and French chalk and etched with etching solution. Every maker of plates for lithographic purposes supplies a special etching solution, and as a majority of American houses use the plates that are specially prepared, it is advisable to obtain this solution from the manufacturer of the plate in use.

After the plate has been etched, it is thoroughly cleaned with water and then gummed up, and the gum fanned dry. After washing it out with the asphaltum solution on the dry gum it is ready for the press and all that is necessary is to wash the plate off with water, roll up and print.

When using the prepared metal plates, American lithographers begin by having their sponges, basins and hands clean and an ample supply of clear, fresh water. It is not advisable to touch the surface of a plate of this character with the hands, as the moisture may leave a stain. The surface is first dusted off with a clean cheese cloth and if dry pumice powder should be used, it ought to be done with discretion, as it is liable to remove the prepared surface of the plate and cause the work to tint.

The impressions should be pulled very black, but at the same time sharp, using about one-half good black ink and one-half good transfer ink, reduced with a No. 000 or No. 00 varnish. When the transfer is patched up it should be pulled through the same as a stone transfer, using slightly more pressure. The plate can either be laid on a stone or on an iron bed, the latter being preferable, as it is less liable to break. A small quantity of gum put under the plate before pulling through the transfer press will cause it to hold firmly to the stone or iron bed, which will be an advantage when rolling up.

The plate should be pulled through sufficiently to transfer the work from the paper to the metal, after which the paper is soaked off. Great care should be taken to remove all starch from the plate as this would have a tendency to cause a tint when rolling up. After the plate has been thoroughly rinsed with water, fan it dry, and, where necessary, touch up either with tusche, litho crayon or lead pencil.

After the plate has been touched up, gum it up, having the gum about the consistency of syrup and rub it up before the gum is allowed to dry on the plate. If it

is a large plate, it is best to gum only a small portion at a time, as when the gum dries it acts as an etch. The rubbing up ink should be any good black ink reduced with thin varnish and turpentine, but use as little turpentine as possible, as, when it is too freely used, it may cause a tint. The plate will not rub up solid, but will roll up after the first etch, after being washed out with the asphaltum solution. When the work is sufficiently rubbed up, wash the surplus gum and ink off with clean water and fan dry; powder with resin and French chalk and etch with good, strong etching solution, after which wash the plate with clean water and gum up, taking care to rub the gum smooth and fan dry. The plate is then washed off with an asphaltum solution; rub this smooth and fan dry, after which wash the plate off with clean water and proceed to roll up, using a good black ink reduced with a No. 00 varnish for this purpose. When sufficiently rolled up, again resin and powder with French chalk, then proceed to clean out dirt spots, etc., using a pointed piece of wood and pumice powder, or snake slip, for the purpose. A Gamberger stone is also very good for polishing out work on metal plates. After this the plate is etched with etching solution very strong; this is washed off with clean water, the plate is again gummed up and fanned dry, washed out with the asphaltum solution and is then ready for the steam press.

In rolling up the metal plates a great many people use the ink too stiff—this is a big mistake. It will be found much better to use a very thin ink. The plate will roll up much easier and not catch up as quickly. This is just the reverse from the litho. stone. In fact all inks

used on metal plates, both for transferring and steam press printing should be ground very short. A small quantity of machine oil or varnish mixed with the ink will sometimes stop a tint where stiff varnish would not.

In patching up a job great care should be taken to prevent any dust from settling on the impressions, as metal plates are extremely sensitive. This is a very important feature to be considered when bronze powder is floating about through the shop. This may appear a small matter, but it is of the greatest importance. Many a transferrer has wasted a whole day in cleaning out small black spots on a plate when it could have been avoided by a little care in keeping the transfer impression covered up.

It is always best to use a damp transfer paper, but should it be necessary to dampen the plate, a weak solution of alum water will be found beneficial. It should be applied to the metal plate freely and with a clean piece of cheese cloth, and gradually rubbed smooth and when sufficiently dry the transfer should be laid down with rapidity.

Do not attempt to wash the plate out as you would stone. Always gum the plate and wash out with the asphaltum solution on the dry gum. Use plenty of clean water in making these transfers, which will mean success to any one attempting to make transfers to metal plates.

The following method of transferring to metal plates is based on the experience of an American transferrer who is familiar only with metal plates, but who is one of the most expert men in this country.

In making a commercial transfer for the offset press, when the engraving is made the regular way, use two kinds of India paper, coated; one piece should be slightly more damp than the other; pull a good, clean, sharp impression from the engraving on the dryer piece, and, if satisfactorily made, take this impression and make a reverse at once (never pull all your impressions of the job at one time)—reverse each impression right away by laying a piece of soft enameled paper, face up, on the stone, then place the blank piece of India (damp) on this face up and on top place your impression and a soft backer (a rubber sheet), and pull through with medium pressure; then take a clean sponge with clean water, first loosening the edges of both impressions, and quickly pass over the top of the impression pulled from the engraving, and before it gets a chance to get wet through pull the impression apart. This will leave the work retransferred on the blank piece. This requires a little practice, but it is a good way.

Another way is to place a damp blotter on top instead of the rubber sheet. After having all your impressions pulled to your satisfaction, you proceed the same as you would for a stone in regard to laying out your sheet and sticking up, etc., allowing for gripper not less than $\frac{3}{8}$ to $\frac{1}{4}$ inch—taking care in sticking up that your impressions are not all reversed so as to avoid making a mistake in the reading matter of the job in hand.

Having your job stuck down O. K., you place a large unused stone in the press and get your plate, we will say one 19x30, and your work is a check 5 on with stub; place your plate on the stone, first carefully rubbing

away every lumpy speck from the surface of the stone to avoid lumps on the plate, then, with a clean cloth, wipe off both sides of your plate, using a piece of cloth, for the back by laying the plate on a sheet of clean paper face down, then dampening your stone and lay your plate with two edges (side and gripper) close to the edge of the stone towards you; now get a scraper 19 inches wide (taking care not to use this scraper for anything else but for your zinc transfers); set your scrapers and get your pressure, using a little more pressure than on stone, using 2 or 3 sheets of soft newspaper (blank) for backer; you then take a clean cloth and rub over the surface of your plate to remove all dust and dirt; then take your rule and measure and make a center line of 30 inches (15 inches), then measure $1\frac{1}{8}$ inch from the end of plate and make two small marks as a guide to lay your sheet on (this is for gripper allowance); now you dampen a sheet of paper and lay it on your work (don't dampen the plate). When sufficiently damp or tacky, take your work and lay the stub end of your check on the two marks of the plate, put your backer on top and pull through about three or four times back and forward; afterward you take your plate up and turn it around with the gripper end opposite yourself, but lay the plate on the stone the same. Now dampen a sheet of paper and lay on top, using the same backer and pull through again three or four times as before, and turn your plate again and proceed the same way again, using a lighter pressure this time to avoid sliding; care should be taken in this course, or it is likely to spoil your job. After having sufficiently dampened your work, you proceed to wash off the trans-

fer paper by a good soaking. Wash your plate off clean. Be sure every bit of starch is washed off. You then dry your plate, get a good fresh tusche and tusche up wherever it is necessary and gum up your plate with a good gum. Do not gum too thick and rub the gum down smooth with a clean gum cloth.

After your plate is dry, scrape your roller and use a medium thin ink with oo varnish on roller. Now wash off the gum with clean water and dampen the plate ready for rolling up the work—care to be taken that it does not catch up. Roll over the plate about three or four times to give the work a start, then dry the plate and if any tusing is required do it, and after this gum up the plate again and rub smooth and dry. Now wash out your plate with turps, on top of the gum, dry plate with a clean rag until all the work is dissolved, then pour a few drops of prepared asphaltum on the plate and with another clean rag go over the whole plate until smooth and dry. Now take your sponge and clean water and wash off the plate until all superfluous asphaltum is removed and your plate looks clean, then proceed to dampen and roll up, gradually getting your work up until it becomes firm and clean and proceed the same as you would on a stone—only taking care you don't overcharge it with ink, using the ink somewhat thinner than on stone, and using it sparingly. When rolled up sufficiently, dry and resin, using sifted resin. Then you clean out your plate with a scotch stone, but never use a needle point to scrape as the plate will show these scrapings on the rubber blanket and may be the cause of making your transfer over.

After the plate is ready for etching, you dry and resin again and go over with French chalk, and proceed to etch with etching fluid. After the etch you gum up your plate again and dry smooth. Then wash out your plate with the asphaltum as before and give it to the pressman. If a second etch is necessary, proceed as before and use a stronger etching solution.

In order to get a good negative on a metal plate first pull a good sharp proof from the job to be worked, on dry transfer paper, first rubbing the paper with talcum powder. Then clean it up well. After the impression is made sprinkle some fine powdered oxalic acid over it, and leave it on five or ten minutes, then clean with a fine brush or a little cotton. It is essential that the oxalic acid be thoroughly removed from the paper in order to insure a good transfer, but of course enough should be left on to do the work.

Now comes the transferring. Take a good, polished smooth plate, roll it up good and solid with strong pen ink and pull the powdered impression through like a regular transfer. It might be well to wet the four corners of the paper in order to be sure that it will stick firmly to the plate.

Care should be taken in dampening the transfer paper not to get it too wet. It will be best to simply dampen the back of it, as the oxalic acid will dissolve in water and cause the lines to lose their sharpness. The pulling through of the transfer needs a little experience in order to learn just how many times it should be pulled through, as too many pulls is likely to spoil the impression. The dissolving of the transfer paper can best be

done with a weak solution of zinc or aluminum acid or gum, which should be left on a few minutes and then the plate should be placed under running water until all the paper has run away. Then wash with a soft sponge until the drawing comes out nice and plain. After this etch it with a weak solution of tannic acid. Gum it up evenly and without washing out roll it up.

In transferring to metal plates the European litho houses use all the various kinds of transfer paper that are employed for stone in their respective applications.

French transparent transfer paper, and oak varnish transparent paper are used chiefly for register color work; the usual stone to stone transfer paper is employed for the metal plate as for the stone.

A most serviceable variety of this latter paper is that known as the Dresden yellow-coated transfer paper.

For transfers from engraved stone a good quality plate transfer paper is used.

In the matter of transfer ink the same conditions are observed for metal plates as for stone, with but little exception, as the same transfer inks are used all round for both printing surfaces; the usual method being to mix one part of transfer ink with one part of a good press black ink for use on zinc plates.

This makes the transfer ink in the best condition for work, as it tones down the greenness of the greasy constituents, and at the same time increases the depth of the black coloration, so that the finest hair lines can be more distinctly seen, and the sharpest effect of transfer thus secured.

Regarding the volume of ink on the transfer paper, as compared to that required for stone, it is a definite fact that transfers for running down to metal plates should be pulled fuller of ink than they would be if pulled for use on stone; yet notwithstanding this fact, these transfers will yield a sharper print from the plate than can be obtained from the stone. This is one of the valued assets of metal plate printing, that infinitely sharper and finer work can be done from the metal printing surface than can be done from the old time quarry rock printing surface, as represented by the lithographic stone, which gives a more thick and smashed effect in printing than is secured from the plate.

After the plate has been roughened and prepared in the manner described the transferrer proceeds to carry out the actual transferring operations. In some cases the boxwood, or pear tree wood press scraper is first levelled up true to plane and this is done by rubbing its V-shaped edge upon sheets of glass paper, or Cabinet paper, as it is variously termed, and these are spread across the transferring bed for the rubbing operation so as to insure that the two actuating pressure surfaces shall be made parallel and conforming to each other.

The metal plate being laid upon its support in the press, which may either be a special iron bed or a litho stone, is carefully dusted to free it from all loose fibres or other adhering matter to prevent scumming or undue friction.

The surface of the plate support is likewise dusted over with a clean rag for similar reasons.

Further, the printing plate surface itself is always

most carefully wiped over before transferring upon it, or "damped," as the requirements of the different classes of transfer papers that is being used may dictate.

In this connection of the preliminary plate dampening operation, it may not be amiss to here point out the important differences that are set up when a plate is dampened with a soft, fluffy cloth, as compared with the same performance when applied to a smooth, polished stone.

The printing plate surface being of a "rough," "mat," "granular" character, causes the soft damp fabric to cling to it when drawn across it, which abrades from off it innumerable tiny particles of detached fibres; these become scattered over the face of the plate, often in the form of tiny pellets which interfere with the perfect transferring of the work to it, causing broken lines or tiny, superfluous "lights"—these being defects requiring "touching up" in the subsequent making ready operations of the transfer work.

Now, as before alluded to, this peculiarity is not near so apparent or possible when a similar soft fabric is employed, for a similar operation in dampening a stone, due to the fact that the smooth polished surface of the stone does not offer the same "tooth," or "rasping abrasion" to the soft material as the roughened metal plate surface does.

It is, therefore, essential that in order to produce the best results with a minimum of trouble, in adhering to this rule, a firm material of a fluffless character should be used; such substances may be found in the use of a fine smooth chamois leather, or a large, close-textured

“cropped” sponge which finds favor with a number of transferers. Others use a fine corduroy material.

If, however, a soft fabric should be used for this dampening of the plate, then it must not be wrung out too tightly, in order that a plentiful supply of moisture may be retained within it, and thus be capable of being readily imparted to the plate surface, without the necessity of having to use any great friction in doing so; this will circumvent the difficulty considerably by reducing the friction.

Then when the requisite provision is made, and the proper conditions are observed and practiced, the careful, skilful transferer is able to secure perfect transferring results from metal plates with the utmost satisfaction and precision, and much superior to that usually attainable from lithographic stone.

For the “making up” of the successive and progressive color plates in multi-color work in England, two different kinds of transfer papers are chiefly used; both of them being of the transparent character. One of these is called the “oak varnish paper” and the other one the “French transparent paper.” Yet, as an exception, there are a few firms that use an opaque variety of transfer paper.

However, of the two kinds referred to, the one most generally popular is that known as the French transparent tracing transfer paper. This comprises a thin rice pulp fibre base, coated with a layer of starch and albuminous composition.

The transfer is pulled from the dry plate or stone upon this paper, and is then “shone up” to the key

sheet, or to an actual sheet of the work in progress. This key sheet is usually a specially well rolled and seasoned manilla fibre paper cut from the reel in the "strong-way-run" of the fibres, *i. e.*, the direction in which it has received the greatest strain and drag in the paper making machine, so that it will have this strongest and most resistive direction available for the strain of the transfer press.

Where large size sheets are being printed, with very tight registering jobs worked upon them; then the key sheet is usually one securely mounted upon a sheet of zinc, so that it shall be preserved against either contraction or expansion, and afford the most accurate and reliable registering medium for all the colors throughout the transferring operations.

Another method but little known, and consequently but little practiced, and yet one which affords many commendable advantages and facilities peculiarly its own, and withal one which is recommended to those who require a speedy, economic and "adjustable" method for color work in progress. Especially and particularly where such chromo work may be undergoing gradual expansion under printing pressure and moisture, as so many classes of modern printing papers are now only too prone to do.

This method consists in first preparing a sheet of thin yet very strong paper, of the full dimensions of the sheets being printed, and then making it translucent and impervious to moisture by varnishing it over with a penetrative coating of best pale oak varnish thinned down with turpentine. This should be done

on both sides of the paper equally to obtain the maximum result; we have known, however, of its being used with the coating being applied to one side only.

When this prepared paper has become thoroughly dry, it is then ready for use, after having first dusted it over with a small quantity of French chalk (talc), which subdues any greasiness or adhesiveness that it may possess.

For use then an average sheet of the printed work in course of progress is taken from the run and laid upon the "sticking-up" board. Then on top of this is laid the prepared varnished sheet; both of them being fastened down taut and secured together to the board by means of drawing pins placed at each corner, and an additional one or two being run through these intervening marginal spaces as additional security.

It is now assumed for illustration's sake that there is in hand a sheet 30x20 inches of colored postcards being printed in 8 colors, and that only four colors of the job have been done; the sheets having stretched considerably during the working of these four printings, so much so that it is now impossible to follow the original "key" sheet to which the first color was "shown up" to, as the dimensions of the printed colors have now become larger than the key sheet.

It becomes imperative that we must now follow the actual printed sheet itself, as when each successive color being printed upon it, the re-applied pressure causes the sheets to "go" a little each time; so that the original "key" sheet becomes less and less valuable for the usual transferring registration purposes.

Now in the method under consideration, we employ one of the actual printed sheets of the job in progress, to serve us as the absolute, precise guide, for the true registration of the new set of transfers, for the next color to be printed. After this is attained we are then able to dispense with this sheet for the "running down" of them to the machine plate.

This is accomplished by "shining-up" each individual transfer on the varnished, transparent sheet, which enables us to see quite clearly the whole of the printed work of the job, lying secured beneath it.

So that the outcome of this is, that we have now our next sheet of transfers fixed in absolute register position upon this transparent shining-up sheet; and this it is which we now use for running them down accurately to the machine printing plate, instead of employing the "key" sheet.

This sheet is virtually impervious to moisture, and of an unstretchable nature, due to the duplex varnish coatings which it has received; and it does not require any further maturing in the running down operations in transferring to cause it to adhere.

Therefore by its aid we are enabled to obtain the next "color set" of transfers down to the plate without misfit, and in true compensation for the vagaries of the expanding sheets of the job that is being printed. No other methods we know of offer the same manifold advantages as these, which are encompassed within the range of this ingenious system, which adapts itself to every one of the peculiar and extraordinary require-

ments engendered by the erratic conditions of the work involved.

Resuming again the "rolling-up" procedure, we may here appropriately refer to another method as practiced by some Austrian transferrers, which consists of sprinkling a few drops of the "asphaltum washing-out tincture" upon the black nap roller when "knocking it up" upon the ink slab at and during the time of rolling-up the new set of transfers just run down on the machine plate.

In some respects this practice is beneficial, but there are at the same time attendant drawbacks attached to it which are apt to nullify its other merits. These have been experienced from a careful testing of this method on a number of different occasions, both in America and England.

A passing consideration of the underlying principles of this practice will soon make clear the points at issue.

When the transferrer sprinkles upon his nap roller some of this "fluid washout," which consists principally of asphaltum powder, fats, and waxes dissolved in solvents such as turps and benzole. The precise formula for which is as follows:

Asphaltum powder	1 lb.
Beeswax	$\frac{1}{4}$ lb.
Tallow	$\frac{1}{4}$ lb.
Turps	5 pints.
Benzole	1 pint.
Oil of tar	$\frac{1}{4}$ pint.
Lavender oil	1 fl. oz.

This liquid solvent when sprinkled upon the black roller naturally softens and limpens the black ink with which the roller is charged. The effect of which is that this ink being then rendered temporarily flaccid and less adhesive to the leather nap of the roller, it is in this condition more readily imparted to the greasy transfer image which forms the work upon the printing plate, when the roller is passed over it in the "rolling-up" operations, and consequently causes it to become more promptly charged with its modicum of fortifying ink than would otherwise be the case without its aid.

But later on, after this black roller has been allowed to stand unmoved for a few minutes, then the turps and benzole constituents being volatile bodies, quickly evaporate out, and thus leave the rehardened wax and asphaltum substances intermingled with the ink on the roller, which then in turn becomes more hard and less distributive than ever; so that when it is again brought into use it really parts with its ink so sluggishly that the transferrer experiences infinitely more trouble in the subsequent rolling-up of his work than he would have done had he omitted the use of this "washout" altogether.

This then necessitates a constant "rescraping" of the black roller, and the "recharging" of it again with fresh ink: all of which involves extra trouble and labor upon the transferrer.

This use then of the "asphaltum tincture" with the rolling up ink may be permissible for emergency work only where a mediocre job is required to be made

ready with unusual expedition, and where circumstances will permit of a speedy rectifying of the roller again to its proper condition.

But now returning to the "washing-out" procedure of the newly formed transfer upon the printing plate and the "rolling-up" of it: there is still another alternative method of accomplishing this, which is regularly adopted by the transferrers of some few litho. establishments abroad.

This method consists of washing out the new transfer as before over the dried gum film; then rolling up the whole surface of the plate solid black by means of the hand roller. This permits of a full firm layer of ink being applied to the work, because in this method there is no water present to retard or diminish the feeding of the job with greasy ink.

In attaining this, however, one has necessarily had to also ink up the dried gum layer on the plate surface as well as the ink work of the transfer interspersed amidst it.

An objection to this method is that it is more difficult to afterwards dissolve off the dried gum layer from the plate on account of this superimposed layer of black ink covering it up.

As an offset to this, however, it might be well to mention that a special roller for this purpose is employed by some concerns, while others adopt an additional set of damping materials.

To a certain extent the specific value of transfer paper depends entirely upon local conditions. That which might be of the utmost value to one litho-

grapher is more than likely to fail to meet the requirements of another one. With transfer paper, as with transfer ink, or cleaning solutions, the main point is to grasp the general principles involved, because there are many varieties of each, and all of them have given more or less satisfaction according to the taste of the workman. Any intelligent workman, by adhering to the broad rules of the trade, is enabled to adapt almost any legitimate transfer paper to his immediate necessity. It is most important, however, that lithograph transfer paper, of whatever variety, should be absolutely impervious to the transfer composition or transfer ink, so that an impression of full strength may be conveyed, leaving the greasy properties of the stone or plate unimpaired. The paper must of necessity undergo special preparation, and here again the character of the work and the conditions under which it is carried out are the chief controlling elements. Until quite recently a great many lithographers preferred to make their own transfer paper, but at present a majority of them are using a manufactured paper that has given eminent satisfaction. Some of the older lithographers, however, make their own paper by using a good blank double foolscap paper, first thinly coating with a solution of concentrated size and afterwards varnishing with a heavy coach body varnish which gives excellent results. Paper thus prepared rarely stretches or becomes distorted to any appreciable extent and may be used with equally good results on either a cold or warm surface.

When transferring large work in which a number of printings are involved, and where accuracy of register is a *sine qua non*, the following mixture may be substituted for the coach body: two quarts of best oak varnish; one pint of turpentine and one pint of boiled linseed oil. Paper thus prepared may be criticised as a rather old-fashioned method, but of the transfer papers now in use, none can claim to be exactly new.

Photo-litho. transfer paper is, of course, in every respect a specific article, the coating of which consists of a gelatineous emulsion, which can be readily sensitized, and upon which a photographic image can be developed. Special preparation and manipulation are therefore necessary in connection with its production.

In transferring on aluminum, work which is damped in the book, is treated in all respects as for zinc or stone. For regular work of this character to be transferred to damp plate, it is recommended by some printers to put a little common washing soda in the damping water, a teaspoonful to a quart being sufficient to make the transfer go down stronger. A difficulty which is not always so easily overcome is to damp the plate so that no streaks of water or loose fibre which come so easily from the cloth remain on the surface. It is suggested by one who has been accustomed to use both aluminum and zinc plates that a sponge of the softest and smoothest quality will leave the least amount of fibre, though even this at times may leave streaks of water. The following plan, if carried out strictly, will obviate these faults: Make a damping book of good thick plate paper by putting

one sheet, passed through water, to two dry sheets, or even one to one. When equally damp through, take one of these sheets, lay it on the plate, and pass through the press under very light pressure, and lift off. This method of damping gives a beautifully smooth film of moisture. The transfer is then laid down and passed through the press very quickly to prevent it rising. After the transferring process has been gone through, warm water is poured over the plate, so that the transfer paper may be easily lifted off, the plate is washed clean, then dried, and given a very thin coating of gum, or laid aside for future preparation. In following out this process, if any touching up is required it should be done before applying the gum; lines may be joined or touched up by using the hardest possible lead pencil, four H or five H being preferred, while other parts can be remedied with a pen or brush in the usual way.

Those who make a specialty of the aluminum plates, place the plate on its end, when the transferring is done, and prepare it for future use immediately. It is first fanned dry, and then thinly gummed over and washed out with a wash out fluid without removing the gum, and of course without using any water. A film of the solution is allowed to remain on the plate and when dry again it is washed over with warm water, which removes the gum along with the superfluous wash out fluid. The work is then rolled up and etched with etching solution, then dusted with either French chalk or resin, either of which will act as an acid resist.

For cleaning up aluminum plates, instead of using the ayirstone and scraper, finger marks and other slight blemishes are removed with India rubber or charcoal on a piece of felt or soft wood; strong spots and lines may be deleted by the use of sulphuric acid, or a solution composed of oxalic acid and terra di siena, applied with a quill or glass hair pencil. After the work is cleaned up, it is etched with an etching solution which is immediately washed off, the plate gummed up, and it is then ready for the printer.

For direct drawing this metal is slightly warmed up and dusted with talc, a soft sponge is then filled with the etching solution and spread quickly over the entire plate, the solution should then be soaked up with the sponge until there is very little remaining, after which the plate is wiped over with the gum sponge and allowed to dry. The work is afterwards washed out with the wash out fluid and treated as already described for transfers.

In making alterations in this class of plates the process adopted by an English manufacturer, and which has been copied to some extent in this country, is to first rinse well and dry and then apply the counter etching solution, allowing it to act for five minutes, and then go over the plate with a cotton pad. The real point to be aimed at in all kinds of metal plate alterations—aluminum and zinc—in deleting the work, is to get the parts of the plate required for alteration in the same state as they were when first handled for transferring.

One method for proving and preparing work on

metal plates is to use the nap rollers exclusively, although some concerns prefer the rubber rollers. When the latter are used, paraffin oil is utilized to clean them instead of turps, and they are afterwards rubbed dry with magnesia.

In printing from metal plates of any description, it must always be born in mind that a great deal depends on the intelligence of the printer, for, as with stones, so with plates, many little difficulties will arise from time to time in connection with special work, which cannot be met by specific rules or recipes; these must be met as they arise, and overcome in the best way possible, which cannot be done unless those interested in lithography keep up with the times. A study of all known methods and the adoption of worthy suggestions, gathered from all sources, if properly applied will be proof of the skilfulness of the apprentice as well as the veteran lithographer.

At the outset the transferrer should make himself acquainted with the character of the work executed, by carefully examining the same and obtaining all possible information from the artist. Upon receipt of the plate the pressman should likewise familiarize himself with the work in hand. This method of co-operation prevents friction arising, if the work does not turn out exactly as desired. The transferrer cannot blame the artist after the work has been rolled up, and on the other hand the responsibility cannot be placed on the transferrer, if, before treating the plate, he calls attention to work which in his opinion is not likely to prove satisfactory. It would be well if this rule was

strictly adhered to, in all branches of lithography, where work passes through several hands for completion. If the artist accepts a plate from the preparer; if the transferrer accepts a plate from the artist; or if the pressman accepts a plate from the transferrer without comment at the time he receives it, then he takes upon himself the whole responsibility of the job being in good condition at the time it was given into his charge.

As a safeguard against uneven etching or gumming up, the transferrer should commence his work by again gumming up the plate with fresh gum arabic solution, removing the old gum coating at the same operation. The plate is then dried by fanning, and laid aside while the press is made ready for working.

The first thing to consider in the preparation of the press is the bed upon which the plate has to rest, and one of the most suitable articles for this purpose is the cast iron bed, which can be obtained from all dealers in lithographic supplies.

In the event of an iron bed not being handy, a perfectly level lithographic stone may be used, and one that is nearest in size to the metal plate about to be worked from. The stone may be placed in the press and the plate laid upon it. Care should be taken that the back of the plate and the face of the stone are clean and free from grit or other foreign bodies, such as bits of paper, daubs of ink, etc., which sometimes make their appearance inadvertently on the surface of the plate causing serious injury to the work.

The placing of a sheet of paper between the stone

and plate, owing to the fact that the paper sometimes creases or crumbles after a few pulls have been made, has not found favor generally as it sometimes causes trouble and irritation.

The pressure is now adjusted and the scraper made perfectly level, any unevenness in the latter being removed with the aid of glass paper.

In the event of a stone bed being used, the plate is made to adhere to its surface by damping the stone and back of plate and run both through the press with a firm pressure. The plate can then be used without fear of slipping.

The press being adjusted and clean water and sponges in readiness, the washing out is proceeded with. Wash off the thick gum, and re-gum the plate with a very thin, even coating. Then fan the plate perfectly dry, and thoroughly remove all traces of moisture. Carefully wipe the edges of the bed so that there can be no possibility of moisture coming in contact with the gum covering, owing to overlapping of rags in the subsequent operations. Now take a clean, perfectly dry rag or other soft material, such as felt or flannel, and wash out the drawing with pure turpentine, using no water to assist its action. Proceed with the washing out, turning the rag occasionally, until the whole of the drawing ink has been removed and the plate presents a clean surface. This is an operation that requires extreme care, the slightest trace of water appearing on the surface at this stage might possibly destroy the whole job.

The plate must be dried by fanning, and then rolled up perfectly solid, without damping, with a roller charged with an ink of from thin to medium consistency. The plate, at this point, presents a dense black appearance, resembling an ink slab. Sprinkle a little water on and roll up again; it will at once be noticed that wherever the water has touched, the plate appears clean, and only requires frequent damping and rolling to entirely clear the design of the ink and gum surrounding it. The roller should be scraped and a few impressions taken, when the work should be nice and sharp and the plate free from scum.

A variation of the above method is to pull an impression from the plate after it has been covered with ink. The plate will then appear grey. The plate should then be damped with the damping cloth, and another impression pulled and it will then be noticed that the plate has cleared considerably. Repeat these operations until the work is sharp and satisfactory.

Another method of washing out a drawing to avoid weakness is to wash off the ink with turpentine as before mentioned, taking great care not to injure the gum coating by allowing water to get on the surface of the plate. Then cover the plate with a greasy coating, such as palm oil, asphaltum solution, or retransfer ink, using turpentine to reduce the same to a proper consistency. When the plate has coated with a thin solution of either of these, or any other solution, the litho printer may have at hand, it should be fanned dry to evaporate the turpentine. Now roll up until per-

fectly solid and black, apply a little water, and roll up again until it is perfectly clear and sharp.

The transferrer must bear in mind, whenever it is necessary to work out the drawing, never to use dirty cloths. A quantity of specially clean rags should be reserved for washing out purposes and every care should be taken to keep them in a clean condition. When the rolling up is completed to the satisfaction of the transferrer, the work is well dusted with French chalk and then given a slight etch with an acid consisting of 2 pints of nut-gall solution, 1 pint of gum arabic solution, and 1 ounce of phosphoric acid.

The plate is etched in the same manner as stone, then thoroughly washed, gummed and fanned dry. In cleaning up it is well to remove any dirt by acid or a piece of india rubber and powdered pumice stone; small specs can be cleaned away with a sharp pointed piece of wood, which has been dipped in the etching solution or into powdered pumice stone.

Again roll up the plate, using a good nap or india rubber roller. Fan dry, dust over with French chalk, etch, gum up, and fan dry again.

If the preceding instructions have been carefully carried out and the artist is satisfied that no additions or erasure are necessary, the next step of proving, or the making of set-offs, can be started.

The usual method of making set-offs is a simple operation. A number of impressions are made from the key plate on a well-rolled bright enamel paper. These impressions are then dusted with a red chalk powder by rolling a quantity of the powder over the

sheet, and giving the back of the paper several sharp taps with the hand to remove superfluous dust from the surface. The dusted impressions are afterwards pulled through on a slightly dampened plate—the result being that a faint impression of the design in red chalk is left on the plate. This method has worked successfully for the litho. stone, and has been fairly satisfactory for metal plates, although one of the chief objections, from the artist's point of view, is that the red chalk is not sufficiently distinct on the gray colored plate. Another is that the set-off is easily removed should it by accident be slightly rubbed. A third objection is that the small particles of powder adhere to the brush and pens of the artist, and so prevent free working.

One of the most effective methods of making set-offs on metal plates is the one about to be described, and one that has been recommended by skilled workers on metal plates.

Pull the impressions from the key-stone on well rolled enamel paper as before; these are then dusted over with the set-off powder by rolling a quantity of the powder over the sheet and then rubbing with a tuft of cotton wool or a camel-hair brush. The idea is to thoroughly incorporate the powder with the ink on the paper, and to remove any stray particles that may remain. The impression is then ready for transferring.

Set a plate in the press, taking all precautions as before described; damp the plate slightly, and after placing the set-off in position, transfer by pulling through the press once with a firm pressure.

The set-off will now appear on the plate in a blue color (though other colors are obtainable); the plate requires no further treatment, and is in a fit condition for the artist to work upon.

The advantages derived from the use of this powder are many, perhaps the principal being that the impression is permanent. It can be handled with much freedom, and cannot be rubbed. It can also be washed with water and yet be distinctly seen. Another good point about this powder is that no dust remains on the plate to clog the pens or brushes.

A third system of making set-offs, specially applicable for chalk drawings, and one which is said to give good results, is to take an impression from the key-stone in a colored ink similar to the color to be printed. For instance, if a set-off has to be made for the red plate, a print is taken in red ink. If for the blue, the key impression is made in blue, and so on. These prints are made upon good strong paper, and pulled with a fair amount of ink on. When ready, a clean sheet of metal is set in the press, washed over with oil of turpentine, and pulled through the press with a clean sheet of paper on top. This will remove the turpentine, but should any remain fan the plate until it evaporates. Now lay the printed sheet in position and pull through the press with a good firm pressure. A good colored outline on the plate should be the result.

Let the plate stand for a few hours, and then wash well with turpentine to remove every trace of the ink. Fan the plate dry and the key will be visible without ink, and the artist has a clear impression to work to

without fear of the chinks being smeared with colored powder. There need be no fear of this key stain working up in the rolling when the drawing is completed. The etching entirely destroys any slight trace of grease that may remain. The key impression will remain in the plate for a considerable period.

In the event of alterations being necessary to the existing work, roll up the plate and chalk well. The parts that require erasing are removed with a small quantity of powdered pumice stone applied with a piece of felt, or else polished lightly with a slip of snakestone.

Another method is to erase the parts with a solution of caustic soda.

When this has been accomplished satisfactorily, wash the plate well under the tap and dry. Resensitize with a solution consisting of—citric acid, $\frac{1}{2}$ oz.; distilled or boiled water, 1 pint. Leave the solution on the plate for a few moments and then well wash, assisting same with a tuft of cotton wool. Dry the plate, and it is in a fit condition for the artist to work upon.

When the artist has completed the corrections, dust over with French chalk, and give a slight etch with the etching solution previously described for the artist's use. Gum up the work, dry and proceed as required.

Transferring to metal plates presents no difficulty if the ordinary amount of care is exercised in the operations. As in every other branch of the art, cleanliness must be strictly adhered to. Damping cloths

must be well washed and sponges kept perfectly clean. They must not be laid indiscriminately on any portion of the press or surroundings. A good plan is to obtain a sheet of plain paper and lay them on this; there need then be no fear of their coming in contact with acids that may have been spilled on the press or tables.

Next, pay attention to the hand-roller; scrape, and work up with a little fresh ink. Also test the scraper and make it true.

Before the plates are used they should be well washed under the water tap and dried. Place the plate on the ordinary cast-iron bed or litho. stone, after taking care that no dust or dirt is on the face of bed or back of plate. Set the pressure a little heavier than is usual for stone, and all is ready for transferring.

All transfers should be pulled full and sharp; writings and drawings on transfer paper should be done in a good strong ink.

Proceed with the transferring in the usual way—either damping the plate or placing the transfers in a damp book. If the transfer consists of many fine lines, the back plate can be warmed over a gas flame or in front of a fire, before the paper and composition are removed. This will give the work a much firmer hold.

When the transfer paper and composition have been soaked off, dry the plate, and do what touching-up is necessary. If the work is in a satisfactory condition, and appears strong and firm, it can be etched slightly with an acid consisting of—nut-gall solution, 1 pint; gum solution, $\frac{1}{2}$ pint; and phosphoric acid, $\frac{1}{2}$ oz; water, 1 pint.

But if the transfer is of a fine character, proceed with the rolling-up. Gum the plate up and dry; then wash the gum off and gum up again very thinly; fan dry and wash out with pure oil of turpentine, taking care that no moisture of any description comes in contact with the gum coating. Roll up the plate perfectly solid and black, then sprinkle on a little water and continue the rolling until clear and sharp.



Proving

UNDER the head of Proving we can give a few general rules and hints on the working of metal plates in the transfer press. Little need be written at this time on the mixing and matching of colors and other matters of general experience, the object being to simply point out the little differences between this process and that of working from stone.

In the first place, look to your roller, and make sure it is adapted to the work in hand. Keep it in good condition by applying a stiff brush now and then. India rubber rollers are good, but they require considerable attention to keep them in condition. For cleaning purposes use paraffin, and after drying with clean cloth, dust over with French chalk. The life of an India rubber roller is much shorter than those with leather coverings. Therefore, for good, serviceable use the nap roller finds satisfaction in most quarters.

Have the inks a little stiffer than for stone work. Clean cloths and surroundings are essential. The plate should not be allowed to stand with a damp surface; if the work has to be left for a few moments always gum up evenly and fan dry.

If trouble arises owing to the presence of scum, add a little tannic acid to the damping water. Or the addition of a little magnesia or starch to the ink will help to remedy this evil. Other remedies for scumming are the use of vinegar, cold tea, and stale beer in the damping water. If the scum is not easily removed, roll up in black, dust with French chalk and give the plate a sharp etch with the nut-gall etching solution, fan dry, gum up and again fan dry, then proceed.

Sometimes trouble is caused through the edges of the plate taking the ink, and applications of the various etching solutions fail to keep them clean. When such is the case the use of a solution of caustic soda will be found very beneficial.

A frequent cause of spoilage of designs upon plates is owing to the fact that sufficient care is not exercised in the washing-out process. Occasionally, it will happen that the plate is gummed up with a thick coating, which prevents the turpentine from penetrating sufficiently to remove the inks. The plate presents a patchy appearance and the workman loses his patience and applies a little water to assist matters. The result is disastrous to good work. If not at once apparent, the edges of the design in a short time will present a feathery appearance, and the finer lines will lose their sharpness. Therefore, immediately the washing out has been completed, roll up the plate in black ink, chalk and etch.

The moral is to gum up the plate very thinly and evenly; do not use a strong grease for washing out un-

less the work is weakly. Ordinary printing inks of good quality are sufficiently strong for average purposes.

Transfer Paper

THE matter of selecting transfer papers is one that should not be overlooked, and which is reiterated in this chapter. The papers mostly in favor at the present time for general work are those of the ever-damp variety. This class of paper has many good qualities that appeal to the litho. printer.

The first good point of ever-damp papers, is that the surface is soft and yielding. By this means the composition sinks into the plate, completely surrounding the design, and so obtains a perfect impression without squash or undue thickening of any part. Then the fact that no damping is required when transferring is another point in its favor. There is also less pressure required when pulling transfers or transferring. These are time and labor saving qualities worthy of consideration. One of the latest products in this class of transfer paper is a sort of combination of French transfer tracing and moist re-transfer and is specially useful for color work, having all the qualities of varnish paper with none of its drawbacks.

Re-transferring

CONSIDERING the rapid perfection of the rubber offset press, it may be of interest to chronicle a good method of transferring from left to right. By laying a properly prepared metal plate directly upon the stone upon which an engraving or drawing has been made (of course having previously been charged with transfer ink) placing the usual backing sheets upon it, and pulling through the press with strong pressure, an impression will be obtained thereon equal in every respect to the original. The counterpart of the original is now to be treated precisely the same as any other transfer made on metal plates; that is to say, it should be gummed up lightly, dried, washed off with water and strengthened by rolling up. The completed transfer is only to serve as an original from which the regular transfer impressions are to be made by the aid of the regular transfer paper to another plate, or stone.

It will be observed that this method makes it possible to squash an impression from one piece of paper to another, for the transferrer now has two plates to work from, if he is contemplating a "from left to right transfer"; at any event he is working from an original, as near as the term can be applied.

By the above process we understand a mode of transferring which is to complete, for instance, the right half of a drawing or engraving, of which the left half only was made, or perhaps one-quarter only was necessary to engrave, and all the rest was left for the transferrer to complete. It is possible to get good results from plates not processed, of course, but it is advisable to secure these plates from competent plate-makers, who know exactly what is needed in this work, and any kinking, or other troubles that often follow home-made plates, is obviated. In completing these "left to right transfers" the plate is taken from the stone and thoroughly cleansed, then rubbed down with pumice powder and a ball of paper, or a felt pad, and water; again rinsed, flowing in a citric acid solution, say 15-20 parts chemically pure citric acid (crystals) in 100 parts water. Care must be taken to apply this solution evenly. After three minutes the plate may be rinsed again, taking chemically purified cotton to rub the plate dry, the object being to remove all traces of crystalline metal. A thoroughly dry cloth is finally used to complete the drying, and the plate must then show no stripes or spots, if a thoroughly serviceable original transfer is desired.

Should it happen that the first effort did not result in a successful original, the plate can be again used by removing the ink with turpentine and a rag, then using another rag with benzine, which will take out all the grease, finally using pumice powder; the plate is given a good polish with that, again rinsed, and prepared with the citric acid solution.

In the event that a plate has been standing a long time with a transfer upon it, it should be treated, after the turpentine and benzine application, with a flooding of hot soda in order to saponify the settled fat, which might have drawn into the plate.

A great many ideas about the various methods of transferring have been set forth in this chapter, and while, as we have previously stated, there is no hard and fast rule—every transferrer having his own ideas about the way his work should be performed—there is enough material to interest the man who is seeking light on the way other people work.



Re-transferring from Type

WHILE there has always been some demand for transfers from type in the lithographic establishments of the country, the advent of the offset press has increased the use of such transfers very largely.

Of course all type transfers have to be reversed for the offset press. The type page, from the first introduction of movable type, has been "negative." To imprint direct on paper would, of course, be "positive." The difficulty of re-transferring from the type form to the metal plate of the offset press has discouraged many good transferrers. Fortunately considerable progress has been made in this part of the business and many difficulties have been overcome.

When the offset press was first introduced it was the prevailing custom to reverse the type forms in the same manner in which the old engravings were reversed—the paper to paper method. Of course a type press of some kind had to be used, as the pressure in type printing—except in the case of the cylinder press—is entirely different from that used in stone printing. It is practically impossible to print a type form on a lithographic transfer press—the same thing applies to an attempt to print from stone on a type press. The one calls for a direct pressure and the other for a "scraping" or sliding motion.

As the average lithographic transferrer had little or no knowledge of type printing, and as the type printer had no knowledge of lithography it usually took two men to make a transfer from a type form to a printing plate. This condition still exists, for that matter, especially where fine work is to be transferred.

In the "paper to paper" process it is best to have the page or form to be printed "made ready" on a type press by a type pressman. This should be done with ordinary type ink. See that every letter shows up plainly on the proof and that the cuts print clear and clean. Make the impression light, but not so light that there will be anything omitted. Now wash the type ink off carefully and thoroughly and ink up the rollers with transfer ink and pull an impression on dry transfer paper. Place this impression face down on a piece of damp transfer paper and run the two pieces through the transfer press with a firm pressure. The damp sheet will now show the form in the negative and ready to put down on the printing plate of the offset press.

In the transferring of the positive image on the dry sheet of transfer paper to the negative on the damp sheet there is always great danger of "squashing" it and spoiling the transfer. This danger is so great that many efforts have been made to do away with the process entirely.

Probably the most successful method of making a re-transfer from type is known as the rubber blanket method. This is practically the same as that previously mentioned, with this exception: In the place of the dry piece of transfer paper upon which the type impression is

taken, a piece of rubber printing blanket is used. This is laid smoothly upon the tympan of the printing press and a light impression is made upon it with transfer ink. The regular offset blanket is best to use. This impression, of course, appears in the positive. Now place the rubber blanket in the transfer press and lay a dampened piece of transfer paper on it face down. Pull it through and you have the negative transfer that is used to lay down on the printing plate of the offset press. This method has been found to be very successful and one enterprising transferrer has patented a machine for stretching and holding the rubber blanket taut while the impression is being taken. The machine is well worth all that is asked for it as it facilitates matters considerably. By this rubber blanket method a perfect transfer can be made nearly every time if a little care is taken.

Still another method is known as the zinc plate process. This is done by substituting a soft, thin zinc plate for the rubber blanket, pulling an impression direct from the type on the plate and then taking the negative transfers from the plate for putting down on the printing plate of the offset press. One great advantage of this method is that the plates can be laid away and kept as originals in case the work should ever have to be duplicated.

A transferrer is one of the most important adjuncts to successful lithographing and the transferrer who can do the same thing in more ways than one is the man sought these days. As nearly every conceivable mode of transferring has been touched upon here there is no reason why the man who has never had any-

thing to do with metal plates ought not to familiarize himself with the latest plan of operation. If he is interested in his work and desires to keep up to the times a close study of the schemes here outlined will, we trust, be of value to him in promoting his ambition.



Metal Plates and the Offset Press

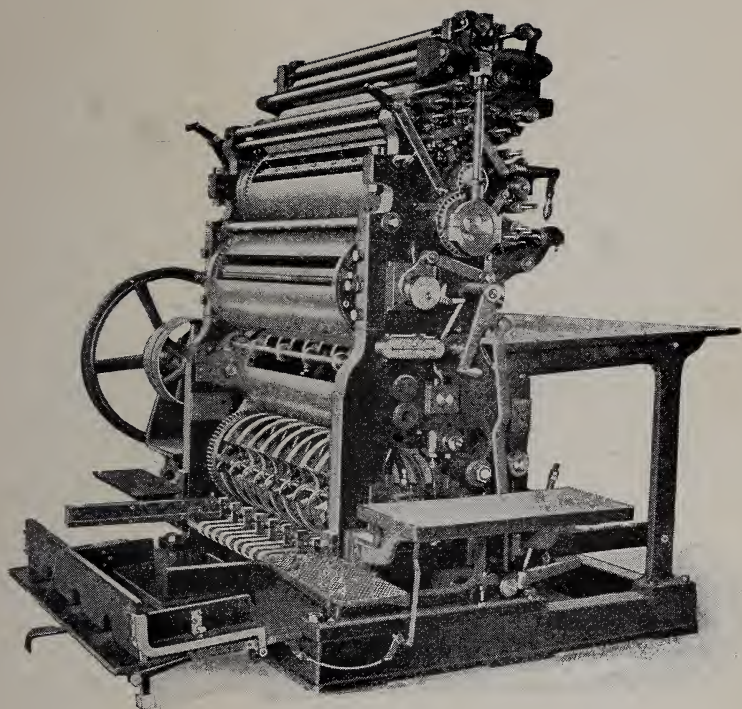
The Mode of Printing

THE rubber blanket offset printing press, the latest product of the press maker's ingenuity, has as its basis the substitution of metal plates for lithographic stones. Without metal plates the rubber blanket press would be impossible, and for that reason it is well to bear in mind the very important part that these plates play in modern lithography. The method of preparing metal plates for the various stages of printing have been fully set forth in other chapters. After the plates have been prepared and the work transferred and rolled up, as described elsewhere, and it is gummed up and allowed to dry, it is then ready, after washing out, for printing.

The process of printing by the offset press is by no means a difficult one. In fact when it is carefully studied one is surprised at the simplicity of the whole affair.

Three cylinders, one to carry the printing plate, another to carry the rubber blanket, and a third to carry the sheet and effect the impression from the rubber blanket to the paper, is all that is required. The fewer the additional parts, the better the press and the more easily it will be learned and understood. Of

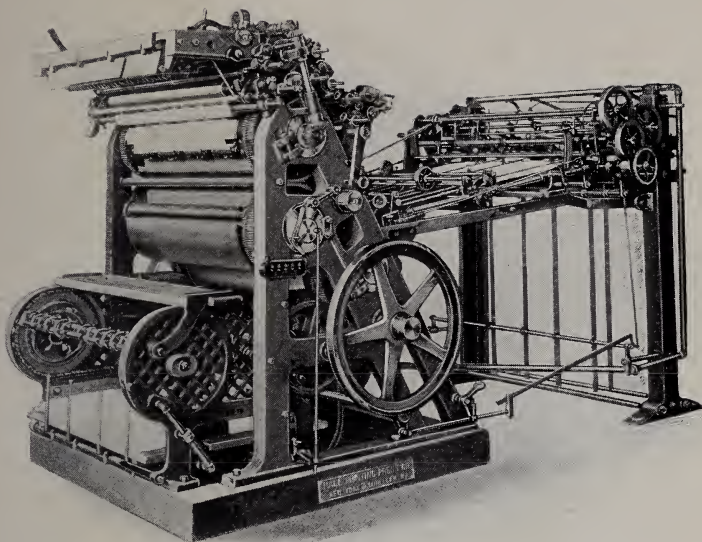
Illustrations of Offset Presses



Rutherford Offset Press

Manufactured by
FUCHS & LANG MANUFACTURING CO.
New York City

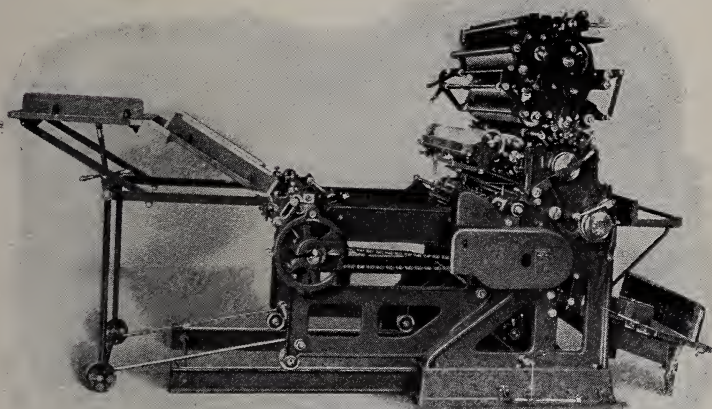
Sizes Made: 28 x 34; 28 x 42.



Hall Rotary Offset Press

Manufactured by
THE HALL, PRINTING PRESS COMPANY
Dunellen, N. J.

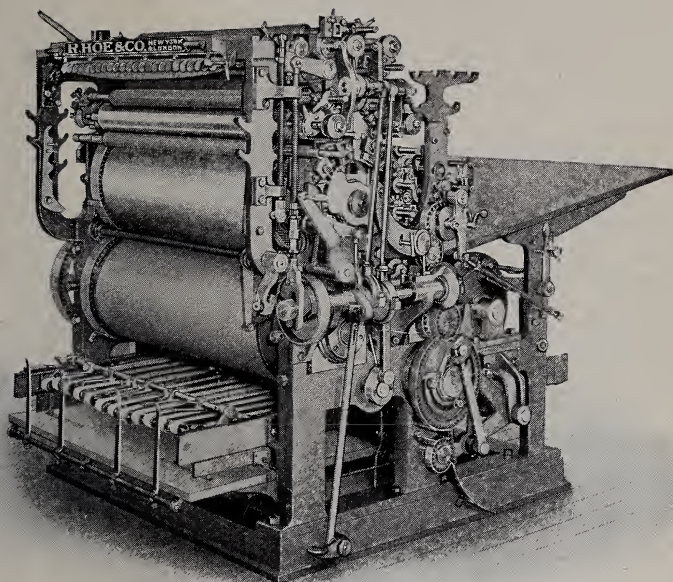
Sizes Made : 28 x 36 ; 35 x 48.



Harris Automatic Offset Press

Manufactured by
THE HARRIS AUTOMATIC PRESS COMPANY
Niles, Ohio

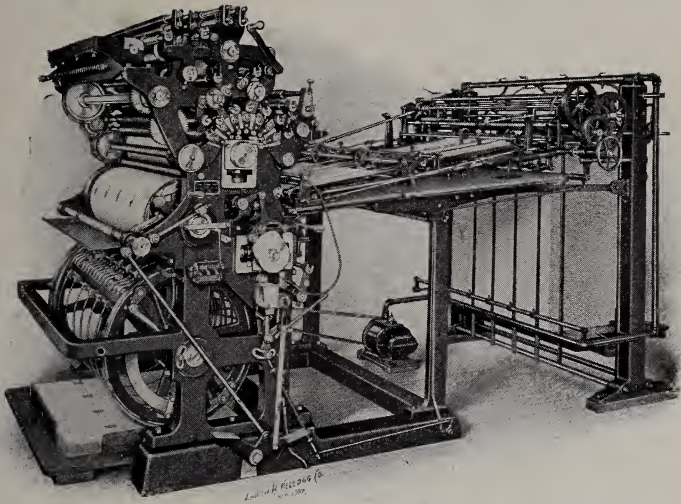
Sizes Made: 14 x 17; 22 x 28; 24 x 34; 28 x 34.



The Hoe Rotary Offset Press

Manufactured by
R. HOE & CO.
New York City

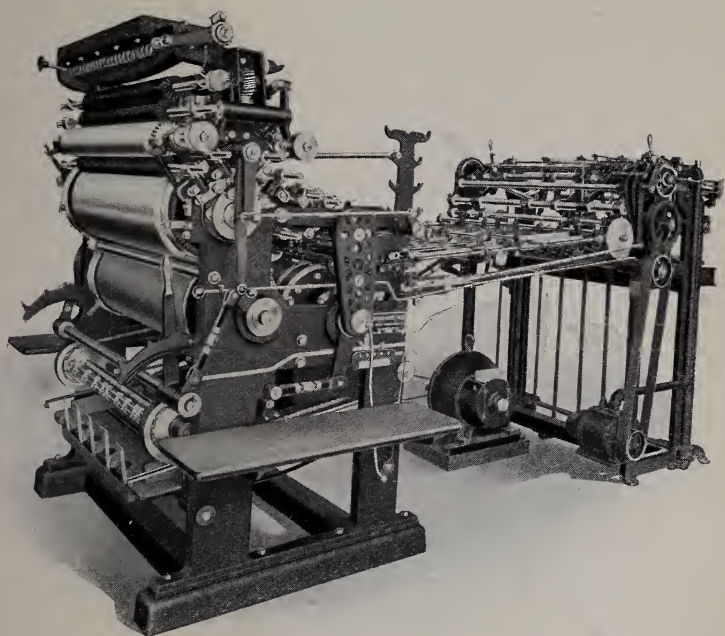
Sizes Made: 22 x 34; 28 x 40.



Kellogg Rotary Offset Press

Manufactured by
ANDREW H. KELLOGG CO.
New York City

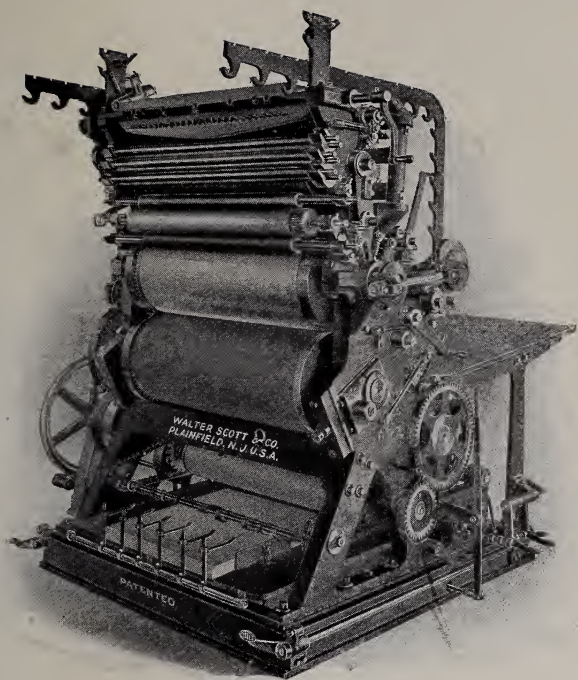
Sizes Made: 34 x 38 ; 34 x 58.



Potter Rotary Offset Press

Manufactured by
POTTER PRINTING PRESS COMPANY
Plainfield, N. J.

Sizes Made : 28 x 34 ; 30 x 42 : 34 x 44.



Scott Rotary Offset Press

Manufactured by
WALTER SCOTT & COMPANY
Plainfield, N. J.

Sizes Made: 28 x 38; 32 x 46; 36 x 50.

course there are a certain number of gears, shafts, and rollers, etc., but primarily the press consists of three cylinders.

There are several features of offset lithography that assure it permanency as a lasting feature of the trade. In the first place the rapidity of the work and the fact that the output of the press can be handled almost immediately after it is printed gives it a place in lithography that has heretofore been vacant. The fact that rough paper can be handled, and a clear, clean and sharp impression secured without the punching through that is bound to occur where type or plates are used or the omissions of parts of the work where stone is used, makes this process of the utmost value to lithographic establishments. When you take into consideration the fact that a metal plate takes the place and does the work of a stone costing many times as much, and all danger of breakage is eliminated, and the plate can be stored in a fraction of the space required by the stone, there can be no question as to why everybody in the trade ought to be interested in the metal plate question.

When it is taken into consideration that the roughest as well as the hardest papers can now be made to take up the ink impression in perfect solidity and sharpness, and with the use of only about one-third the usual amount of ink on the work that would be necessary if printed direct from stone by the flatbed or direct rotary machines, then the vast importance of the offset method will be at once apparent. This power of securing a more solid and sharp impression with a

less volume of ink preserves the work on the plate, as it does not have to be fed with an overplus of ink to fill in the pores of the paper during impression, as is the case when printing direct from the actual printing surface to paper, and, consequently, the trouble of filling-in, scumming, and thickening of the work is virtually prevented by removing the chief cause. This means longer runs without deterioration of the work, and less trouble for the machine man in applying solutions and antidotes to both ink and dampening water, to say nothing of the economy effected in the amount of ink consumed. As either zinc or aluminum plates are employed as the printing surface, an additional economy is here effected over the use of stones.

So elastic and adaptive is this rubber offset impression method that such uneven surfaced papers as imitation crocodile skin embossed papers are perfectly printed upon, even with such work as fine copper-plate headings, and without destroying the indent markings of this peculiar paper—a feat unattainable by any other known process of printing. With such absorbent papers as common brown wrapping paper we have secured a perfectly flat and solid impression with the thinnest film of ink on the forms. There is absolutely no need for etching the work into high relief: in fact, this would be a drawback for this class of machine, as the rubber blanket would soon become indented and rendered uneven for succeeding work.

The sheets receive much less pressure than they would do if printed direct by the old method, and as the rubber impresses the ink most delicately to the

paper—similar to the fleshy pad of the human finger—there is less stretching and distortion of the paper during printing, less risk of creasing and overlapping and so much better register can be obtained for color work on plain papers.

But the merits of the offset machine are not alone confined to the improvements effected with the old form of work. For example, lithographers can now accomplish with photo-mechanical half-tone work what has hitherto baffled the typographers to attain, that is, they can print ordinary half-tone images on plain uncoated papers, free from the injurious gloss and glare of the highly glazed coated papers now in universal use for this work. Thin paper can be used as successfully as thicker paper, and thus both the weight and the bulk of the printed sheets will be most materially reduced.

In printing half-tone work by the rubber lithographic principle, we get a pure solid dot impression, not, as with the typographic process, the raised point of the half-tone forced partially into the glazed paper surface, so that the center of the dot becomes denuded of its ink, as this has, during the act of impress, become squeezed out around the outer edge, in the form of a very obtruding penumbra. This drawback is eliminated by the offset method and if use is made of the high light and sensitive process method, we have the most perfect half-tone printing methods extant.

When the first steam or power press was introduced in this country about forty years ago, like most new inventions, it was greeted with the utmost contempt and

condemnation by the lithographers who failed to see anything good in the new order of things. However, the steam press has been used ever since and it was the making of the lithographic business in a commercial way. Then press manufacturers began to experiment with the steam press and from that came the metal rotary press. The French claim that as their invention, while an American manufacturer avers he was the inventor—however, it came, and added improvements have given us the rubber-blanket offset press, which gives us the premier position in modern lithography. With this offset it is possible to make a transfer on metal, in much less time than it takes to transfer to stone, put the plate on the press in less time, and instead of printing 1200 impressions an hour, or 7000 a day, several hundred establishments are printing more than 5000 an hour and the work covers every phase of lithography.

The progress in reaching the present stage of efficiency is very interesting. With the introduction of metal plates the wise printers were not content to work in the old way on flat-bed presses with their small output and those engineers of an inventive turn of mind directed their attention to the construction of rotary machines on which the plates could be used. When it had been demonstrated that the rotary press was a thoroughly practical machine, the builders decided to go a step farther and try a press that would print two colors at one time—a two-color rotary. Never had it been commercially practical in lithography to print two colors from stone in one run through the old flat-bed press, although two-color flat-beds have been made.

Inventors, lithographers, and press builders have striven for years to perfect a machine which would allow them to put on the various colors of a picture in one run through a press. It was found that perfect register was obtainable in a rotary press, and from the form of construction of the machine it was possible to put in a third cylinder and an additional set of rollers, and put two colors on the sheet of white paper before it had passed through the press. Great as this improvement was in surface printing machinery, it was but a step to a three-color press, with the effects which are obtainable with the combination of three colors. Then still further improvements were made until now we have the rubber offset which can do multi-color work with startling rapidity and effectiveness.

The rubber blanket, while not new in its application to printing, was formerly confined to tin printing, and its introduction to commercial lithographing dates back but a few years. It was found that an impression, because of the elasticity of the blanket, could be had which would bring up every line in the engraving, no matter how fine it was. No matter how fast the press ran the work came out just the same. It was soon seen that the rubber blanket would print on a sheet of dry bond paper, as well as a stone press printed on a sheet of "super" or on a damp sheet of bond, and the very nature of the impression showed that if the ink rollers were working everything on the engraving must come out and come out clear. That settled the question of the practicability of the offset press for commercial work. It was agreed that a press that would turn out 5,000 sheets an hour and

run along like a sewing machine, printing on dry bond paper, and bring out every line perfectly, had passed the experimental stage. Every sheet came out perfect and no accident of any kind occurred to stop the run.

It was at this stage that it was generally agreed by lithographers who saw the offset in operation that it was adapted for commercial work. Since then the color work has been advanced to a state of satisfaction, if not entirely efficient, and each day greater progress in this phase of the machine is recorded.

But to get right down to the way metal plates are handled after they have passed through the transferring process, which is the object of this dissertation: The several manufacturers of the offset press construct their machines differently, of course, but, as said before, they are in the main similar. There are three cylinders, although each machine possesses its variations and peculiar distinguishing features. The top cylinder in all of them is, however, the bed, or plate cylinder. Around this the metal plate is clamped for printing. The middle cylinder is the rubber or offset cylinder, while the bottom one is the regular tympan or printing cylinder. The inking arrangements for the printing plate are not unlike those on a web press, but the inking rollers provide a greater distribution than on any other machine made. In connection with the plate cylinder is a water fountain and a set of water rollers made especially for the offset press. The water rollers are locked down upon the plate cylinder before the inking rollers, and the machine is ready for business. The whole surface of the plate is damped except the transfer parts or the substances to be

printed, and of course the water does not act upon the greasy parts in any way: Now the ink rollers, passing over the plate will deposit no ink where the plate is damped, but they ink the transfers to the required strength. The inked up transfers print on the rubber cylinder, the sheets fed into the tympan cylinder receive their impressions from the rubber blanket and the work is done.

The metal plates used are as thin as fine paper and the cut-off on the plate cylinders is only about one-sixth as deep as the cut-off on most of the flat-bed cylinders. When you look for the bearers on the offset press you have to feel for them. Anything like so shallow a cylinder on the old-fashioned press would wear out the printing material in no time. It is right here, if nowhere else, that the offset press has achieved a triumph which will afford press manufacturers something to think about for some time to come. It has greatly reduced the terror of that awful word "wear." The plates used are granted lasting qualities for the reason that the pressure exerted upon them is very slight. It prints upon a rubber blanket of five-ply thickness, which is somewhat thicker than a rubber boot-leg. A man can press his thumb upon it and make a deeper indentation than takes place at each impression. This relieves the mechanism of all strain, and leaves the cylinders free to travel in absolute unison, which has heretofore been impossible. It makes no difference to the offset whether it is turning out a heavy printing or a light one, the resistance in one case is not materially different from the other. Rigidity of construction, it may be said, has been placed almost second-

ary to accuracy of contour, and in this last the builders have reached a degree of perfection never before realized. The variation in the printing surfaces of the cylinders are so slight that, were it mentioned by the fractional part of an inch, the expression of the fraction would consume a whole line in this book.

An offset press does not have the appearance of running at such terrific speed when you stand alongside it, but when you get in front of one you see the sheets falling like so much confetti on election night. The absence of static electricity in the paper is remarkable and proves that it has always before been the result of friction. The sheets are gathered on a skeleton cylinder and delivered three at a time, or else they shoot out one after another in the manner that grain comes from a thrashing machine.

Some times wonder is expressed that so thin a plate can be locked on the cylinder. The plate is made in various sizes to fit and instead of catches being used to clamp them on they are clamped into the openings in the cylinder.

Offset presses will not consume much ink, and therefore the quality must be there. If too much ink is used it makes trouble, but the ink makers are up to the times and are making the best ink of their lives; the pigment must be put into it, and less oil, etc.

The metal plate—about which this work has been written—is the chief adjunct to this new press.

Out in Cleveland an establishment is turning out sheets printed in eight colors on a 34 by 44 offset press, and beats anything so far seen in the color line. The

best of inks were used, of course, and the metal plates were prepared; while it is an every-day occurrence to see the offset—one kind or another—turning out four-color work, and presses in other establishments are doing the same thing in all parts of the country.

In Europe members of the lithographic craft regard the offset press with suspicion, and only recently British lithographers reluctantly conceded that they were adaptable for commercial work, such as invoices, memorandum forms, billheads, letterheads, policy forms and labels, possibly in two colors, and such like work, but a job of high-class chromo postcards, done in no less than fifteen colors, from a German offset press has literally startled them. It affords some indication of the rapid developments that are taking place when we record that the basic process used for these postcards was a photographic original on a metal plate. The finished chromos are most pleasing, tasteful productions, and were printed from the offset machines at a higher rate of speed than this class of work was ever done before.

With the general principle of the offset press fully recorded it will no doubt be interesting to show something about the peculiarities of the several makes of this new process. As previously stated each make has its own little wrinkle and characteristics, and we shall endeavor to point them out without fear or favor for the benefit of those interested in the subject.

The Offset Process

A YEAR or so ago The National Lithographer made the assertion that the offset press would revolutionize the lithographic trade and it was scoffed at by many old lithographers who contended that while it might be possible to do some kinds of commercial work by the rubber offset process, the idea of doing color work on an offset press was the height of folly and the ravings of one unfamiliar with the subject.

It was pointed out that as the work had to be transferred to a metal plate and printed first on the rubber blanket and then to the paper, it was obviously impossible to do color-work on such a press. In the first place you could not carry color enough, then the register could never be made close enough for a color job, and then—well, all kinds of arguments were offered, and some of them sounded quite feasible, but finally first one press and then another got a trial at color work. One man put a color job on his offset press because he had no other press on which to work it—and he had to do the job. He was surprised at the quality of the work—as, also, were the other people who tried to do color work from their rubber blankets, but the work went right along and some very creditable jobs were turned out.

But the scoffers said that coated paper could never be worked on a rubber blanket press. Of course every lithographer knows that coated paper is an “effect” rather

than a "cause." People use it for certain kinds of work because they cannot print the work on paper unless it is coated. With the offset press it is not necessary to have coated paper in order to get the right effect—the offset printing attends to that—but some people insisted on coated paper and the offset press seemed to take to that just as it took to everything else that was offered to it. But the scoffers "stood pat" on the half-tone. There was a condition under which the new process must fall down. No offset press could possibly carry ink enough to enable it to print a solid half tone—that much was sure. The owner of an offset press put a half-tone down on a plate and started up the press. While it was a slow job to start the first time, the press not only printed it perfectly, but actually printed it on rough paper that the type press could not have worked to have saved the country from going to the dogs. The scoffers still maintained—and probably always will—that the offset process is not suited to any other kind of lithography than the commonest kind of commercial work, but in spite of that the different makes of presses are grinding away on almost any kind of work and getting away with it, while the scoffers, like a small coterie of Civil War veterans who refuse to admit that the war is even now over, still "stand pat."

Those who have used the offset press have found that the cheapest material from which lithographing or printing can be done successfully is the metal plate. A plate of this kind large enough for the biggest press costs less than five dollars, already to receive the transfers. Plates can be put aside and kept for years and then put on the press and run again. In the meantime they can

be placed on a shelf or in any dry, clean closet without deteriorating.

For magazine printing this new process offers a money saving proposition that cannot well be allowed to pass by the publisher. In the first place the process admits of doing fine magazine work on paper of about one-half the thickness and weight of that now universally in use on work of that kind, and at the same time gives the reader just as fine looking work, and the advertiser all that he could conscientiously ask for. A net saving in paper of fifty per cent. and the same in postage is assured. When the plates are to be preserved, as is the case with most publishers, the metal plate offers advantages that the electrotpe never possessed. It takes up but a fraction of the space called for by the expensive electrotypes and will require practically no preliminary work in getting it ready for the press when a new edition is wanted as the form is already made up and ready to run.

The question of printing color lithography on an offset press has been before the lithographic public for some time—in fact, ever since the introduction of the offset process. There are now on the market seven different makes of the offset press and nearly all of them are capable of doing good color work. Some of them are printing in eight colors on sheets 29x43, and there are no heavy ones or light ones among them—the sheets are uniform.

Indeed, some of the samples were printed from engravings made on stone for a stone press, and, although it is the generally accepted theory that work made direct comes out clearer than the reversed output, seems to have

made no difference. It is a fact known to those familiar with the offset press, that old, worn engravings can be made to show better work on the offset press than upon any other press on the market.

While it is true the offset press was intended primarily for commercial work, it has gradually been working its way into the color field and it has made good from the start. Some of the jobs of color work on exhibition in the office of The National Lithographer, made by the offset process, would be a credit to any process of reproduction extant, and demonstrate beyond any possible doubt that in the field of fine color work, the offset press is to be a contender in the future.

One of the latest offset presses is one that prints both sides of the paper satisfactorily. There are two large cylinders, divided in two distinct halves, each half of one cylinder carrying the plates for "first printing" and "reiteration"—eight pages of music on each half-cylinder. The other large cylinder is divided in half to correspond with the plate cylinder, and on each section is fixed a three-ply rubber blanket. Each revolution of the large inked printing plate cylinder transfers the music pages on to the rubber sheets on the second large cylinder. Immediately above the rubber blanket cylinder is an impression cylinder half the size of the larger ones and also covered with a rubber blanket. This small rubber cylinder receives the inked up impressions from one half section of the large rubber covered cylinder and presses it against the sheet to be printed in due order for perfecting, and, in its revolution, presses the other side of the sheet against the impression on the other half of the large cylinder, thus printing both sides at once. The

sheet picks up the inked impression from the rubber sharply, clearly and cleanly, without the slightest defect of any kind, the finest line work is as clean and solid as the heavy colors, and the register is said to be perfect.

This machine, an English invention, can be used for printing two separate impressions on one side of a sheet. This is accomplished by turning over the gear connection to a different position, and is done easily and with but small loss of time. The damping and taking-off arrangements are entirely automatic and easily regulated. To test the delicacy of impression of the new machine, some very coarse hand-made surface-ribbed deckle-edge paper was provided and run through to demonstrate that even this almost impossible paper for lithographic printing could be made to receive a good impression, a test which is said to have elicited the unstinted approval of those who witnessed the exhibition.

Every day somebody discovers something new about the machine and the process that nobody dreamed of or believed a short time ago. Work has been produced on it that practically demonstrates that anything that can be lithographed at all can be done on an offset press. While one man makes a specialty of half-tone and type work, having acquired the knack of doing this kind of work a little better than anyone else can do it, another man discovers that maps and work of that kind can be done to better advantage on an offset press than in any other manner. Some people, on the other hand, have installed offset presses with the idea that once installed all that is necessary is to throw the copy at the press and the rest will be done automatically. This is a great mistake, for, while the offset press is undoubtedly revolutionizing the

lithographic trade, it requires skill and attention to make it work successfully. The many beautiful samples of lithography turned out by the offset press demonstrate clearly what can be done on it and, despite the skeptical, the more we see of the product of the offset press, the more thoroughly we are convinced that it is the process of the future. All that is necessary is proper material to work with, a little experience and good, hard common sense, and it can be made to turn out beautiful sheets of a regular job.

Metal Plate Press Work

LITHOGRAPHIC machine printing presents many peculiar features, each one of which requires careful and constant attention for their successful operation. The pressroom being the most important department in the lithographic establishment, it becomes imperative that the presses are made to run to their utmost capacity, whether they be the flat-beds or the rotary machines. A small amount of dirt will make more trouble for a pressman who is printing from metal plates than any one thing that he comes in contact with. This matter of cleanliness extends to the back of the plate that is to be used as well as the surface. It is, therefore, necessary to see that the back of the plate is thoroughly clean before the plate is clamped on the press. It should be wiped off carefully,

and the cylinder as well, to prevent particles of dust and sand from lying between the bed and the plate.

Another important thing to remember is to have good grained rollers when printing on a rotary press. Rubber rollers are sometimes worked with success, but a leather roller is the best that has been made for the purpose. They require a great deal of care to keep them in good condition, and should always be kept soft, but not greasy. In running a metal plate it should always be *gummed when stopped*, and not left standing under the ink rollers, as there is always a little moisture in the rollers which will sometimes injure the plate, which has a tendency to absorb water. It is best therefore, to always sponge off the plate before starting up the press. Should a plate have a tendency to scum, a weak solution of neutralized nitric acid or a small quantity of gallic or tannic acid with a little gum added to the water in the water fountain will prevent it. There are preparations for accomplishing this purpose manufactured by the makers of the processed plates, and where prepared plates are used it is best to purchase such solutions from them.

When the metal plates are being set and started perhaps the best advice to give the machinist is to be systematic in his working. The morning's start should begin with the oil can. Go over the machine and its working parts yourself. Do not trust an inexperienced boy to attend to this important part of the day's routine. See that oil-holes are clear, and lubricate most of those parts of the machine that have the greatest wear. Carry a rag or piece of waste in one hand to mop up any oil that may overflow, and to clean away any dust or dirty oil that may have accumulated.

Examine the ink rollers next, and if any of the skins are loose or baggy, have them rectified at once, and also see that the dampers are in good condition.

When using the ordinary press, the carriage bed should be periodically examined and cleaned. If a stone is used as a support to the metal plate it might be well to use a piece of elastic bedding underneath it to lessen the risk of stone breakage.

When choosing this material it is well to see that the waterproof quality is obtained, any other sort being a source of danger owing to its uneven swelling with the application of moisture.

Assuming that all these preliminaries have been carried through, and that the stone or iron bed support for the plate is at hand. Proceed to set as usual, using the spirit level first, and then, after lowering the stone, turn the cylinder over and raise the carriage evenly until the stone is firmly pressed against the cylinder. Do not screw too tightly, but allow a little for the thickness of the plate that has to be placed upon it.

The plate should be ruled along the front edge with a pencil to mark the exact margin to lap over the edge of the stone. The plate can now be inserted between the front locking-up blocks and the gripper edge of the stone. This is accomplished when the carriage of the machine is extended. When fixed in the exact position, bend over the stone, place a sheet of paper on the face of the plate and turn the cylinder slowly until it reaches the back edge of the stone. The plate by this means is flattened upon the surface, and is held securely while the back edge is bent over the edge of the stone.

The impression cylinder can then be released and the plate locked up in position by pressing the blocks against the sides of the stone. If the plate, after locking up, appears to be a little slack, insert a long strip of wood between the bent edges of the plate and stone. Lock up tightly against this and it will become perfectly flat and taut.

When using a cast-iron bed as a support for the plate, level it up in the same manner as you do a stone. Bend the two edges of the metal plate to correspond with the width of the surface of the bed. Clean well the back of the plate and the top of the bed. Insert the plate at the gripper edge of the bed and lock up with the middle and end screws. Then repeat the operation on the back edge and tighten all the nuts. Run a few waste sheets through without removing the gum coating and without the use of dampers and inkers. This will cause the plate to stretch a little and settle to its proper level. The bars at the back edge of bed are then tightened to take up the slight stretch, and the bed can be locked up and the register obtained in the usual way.

Supposing that the machine is now in readiness for printing, spread a little ink on the rollers and let it distribute well before allowing it to touch the plate.

The start should be made with a spare supply of ink rather than too much, until the correct quantity is reached.

If the plate has to be printed from in black, the design can be washed out as before described and rolled up with the hand roller. Or if the job is in color, gum the plate up thinly, wash out with a clean dry rag until all traces

of the old ink are removed, apply a little grease or asphaltum, add a little water and wash clean. The machine rollers can now be dropped and the plate rolled up in color.

When making a start and obtaining register, etc., do not run the same sheets through more than two or three times, less if possible, as this is a frequent cause of work thickening owing to the amount of ink on the sheets being continually pressed upon the clean parts of the plate.

It also causes trouble by transferring some of the ink to the cylinder brush, which afterwards marks the clean paper as it goes through the machine.

Do not fail to gum up and dry the plate if the machine is stopped at any time. The careful observation of this rule will keep the plate in excellent condition and remove one of the sources that cause the work to thicken up.

If, when printing, the plate commences to tint or scum, the machine should be immediately stopped, the plate rolled up in black, chalked and etched. Then add a little magnesia to the ink or a few drops of tannic acid to the damping water.

A little caustic soda solution applied to the edges occasionally will keep them clean and prevent the ink from catching.

The foregoing advice on machine printing will give the beginner the chief lines of treatment necessary in setting and starting plate work.

If the instructions contained therein are carefully followed, there is no reason why the pressman should not produce, at the initial attempt, work in every way equal to his best productions from the litho-stone.

Of all the parts of the press which have an influence on the register, the grippers play the most important part, no matter what kind of a machine is in use. When these parts are not in order, that is to say, when they do not hold the sheets equally fast in all parts, exact register is not possible. Naturally the difficulty is less with small sheets; with larger sheets the grippers come into play more often, and consequently there is more likelihood that an equal number do not come into operation, one or the other of the grippers not holding the sheet so fast as the others. These differences appear still more when the grippers through striking, have become bent. They should never be hammered, as is often resorted to, though if it is done it should be done only by the most expert manipulator. Equally with the grippers the feed guide should receive attention. Where it is not smooth, or where the edges stand up too high, the sheet is pressed downward, or with paper which is wavy so that it does not lie smooth, the grippers cannot get a good hold without pushing the sheet away. This is a most important point in the effectiveness of the feed guide.

Of the many annoyances associated with the machine printer's task, grit is probably the most troublesome, inasmuch as its presence is almost imperceptible, while its effect is extensive and often disastrous. Its sharp grains become embedded in the inking-roller skins, and plough tiny furrows across the printing forms, doing much damage before the printer realizes the presence of any foreign matter on the inking-rollers. Dust the rollers and examine them carefully before commencing operations, and in this way ensure perfect cleanliness at the start.

This may seem a trifle, but trifles make perfection, and perfection is no trifle, some wise man said, and by adhering strictly to the rules of care and cleanliness in the handling of metal plates there should be no trouble with grit or other like substances.

In conclusion the publisher of this book again urges the younger element in the lithographic trade to learn the business from the ground up, not forgetting that lithography, although more than a hundred years old, is in its infancy right now, and is only beginning to take its place in the commercial world. More progress has been made in the past few years than actually took place in the previous century, ignorance and prejudice, to say nothing of the foolish secrecy that prevailed, keeping this beautiful art confined to a narrow sphere. The young man in the trade faces a bright future, if he will devote his time and energies to mastering every detail of the work in hand, and keep abreast of the times. The older men, or at least some of them, will argue forever more that nothing can ever take the place of the lithographic stone, but they are wrong, sadly wrong, for the metal plate process of lithographic printing has demonstrated beyond peradventure of a doubt that it is a permanency.

Photo-Lithography

Its Growing Importance

THE wonderful strides that have been made in Photo-Lithography are no less remarkable than the advance recorded in metal plate printing and the wonderful achievements accomplished by the offset press. This has resulted from a series of experiments which has brought Photo-Lithography, with its many branches and its extended application, to a point where it is useful for the graphic arts, not only from a practical standpoint, but in the artistic sense as well. Like the metal plate and the offset press, its use has been restricted by prejudice and custom, but in the near future it will be a great acquisition to the lithographing trade when it is once generally recognized that it is possible by that process to prepare a plate or stone by the aid of photography from any original. It matters not whether it be a drawing, a print, or an oil painting—larger or smaller than the original can be reproduced in the lithographic press.

Photo-Lithography, in fact, has developed so rapidly of late that it is almost inconceivable to comprehend its possibilities. A new enterprise, having as its basis this process, recently began reproducing oil paintings by means of the lithographic press and the success has

created something of a sensation in lithographic circles. This new process makes its headquarters in Chicago, and, while the company working it proposes to enter the advertising field, oil paintings were recently produced on canvass with such fidelity that the work could not be distinguished, a few feet distant, from the original painting. Notable examples of oil painting reproductions are a painting of Sir Wilfred Laurier and one of President Taft. They are both mounted in heavy gold frames, and are attracting attention from the public generally, and lithographers in particular.

Photography was not discovered by any one person, but was evolved by many minds. Through the revelation of Mungo Pouton, in 1839, that chromic acid is extremely sensitive to light; through the disclosure that chromic gelatine becomes insoluble in warm water, by Talbot, and, finally, by the adaption of these principles to pigment, carbon and photo-lithography by Poitevin, a new field was opened up to graphic endeavor; the screen process being its highest realization on the printing press, and fully incorporated in lithographic methods today. The unexcelled principle of the litho-transfer, the extreme fineness of the Ben Day film, the introduction of metal plates, self-feeding machinery, the rubber blanket offset, rapid printing presses; in short, the host of mechanical and chemical devices open to lithography, form a constantly growing galaxy adding new triumphs to the art. Lithography, it can be truly said, is mistress of all processes, because it is the method par-excellence, of the combined mechano-chemical processes, finding its fullest,

most far reaching and economical exemplification in its versatile methods as practiced today.

Through the advent of photography and the immense flood of light which it shed upon the reproduction and development of art, lithography was at once projected as the one method capable to participate most prominently with, and maintain her dignity toward all; for instead of losing prestige, lithography blossomed out in new array, in rich colors, and at present stands unexcelled as the queen of chromatic reproductive methods; artistically potent and commercially capable, she is the central figure upon the grand dome spanning the glorious structure of the graphic arts today.

Imitation of the marvelous color displays of nature by the camera is the goal of photo-lithographers, and the camera now has the same power as the human eye—it can not only see, but it can reproduce color—and through it the lithographic trade will multiply its productions and extend its importance as an educator of the masses. Soon it may not depend upon the translation of brush and palette to gather the secrets from the garden of Mother Nature. Upon this little globe of ours, floating in infinite space, the lithographic employer, as well as the lithographic employee, has become really an intellectual being, constantly setting before the public gaze the highest examples of art and striving to teach ideal color-culture as rendered in the grand displays of nature.

The progress of chromatics will not cease. It has been planted in the human soul and is essentially for the advancement and progress of coming ages. The lithographic art is emerging from the confusion of mingled

colors, when registering marks were pulled apart, plates began to tint, streaks began to appear, and even solids walked right off the surface, and the progress being made, cannot be checked by the little men of the planet who always oppose things new and novel.

One of the most successful and beautiful photo-litho processes before the public at present, is that adopted by Frey, of Zurich. In this process the work is done entirely with zinc. The sketch, or other object to be reproduced is photographed through color films onto a plate coated with an asphaltum film. In the development, minute particles of asphaltum wash away, and leave the tones of the picture broken up with an exceedingly fine, irregular grain. These are three color photographs taken and from these three are produced the number of colors necessary for working the design. The various color strengths are gotten by under and over developing. For instance, a pink or flesh tint would be obtained by under developing a print from a red negative, supplemented by a fair amount of work put on by the litho. artist, such as filing in solids and taking away the high lights. The impressions from this process are very fine, and, as works of art, bring good prices.

The question is often asked by many lithographers: Has not the camera in lithography driven out the artists element in the trade? In answer we say most emphatically, No. The chromo-optical process of making pictures has been nothing but a valuable acquisition to commercial lithography and has hurt no one. We need only to compare the results produced by that class of lithography twenty years ago, with that turned out today, and we will

find where fifteen colors were used then, seven or less are used now, with the same effect. Naturally, in order to obtain this economic advantage the technical part of the work had to advance 50 per cent; so we find at present the work must be finer and closer, the textures must be more marked and diverse, the work more accurate, and at the same time it must be truer to nature. Photography and process have forced the lithographer to advance likewise in his Ben Day, crayon or stippel work. So that instead of shedding a baneful influence upon the lithographic art, it has certainly benefited every one even remotely connected with the lithographic trade. It has educated the mind and eye of artist and public, as well as accelerated the dexterity of the lithographer's hand—in other words, the graphic arts would have retrograded if it had not been for photography.

For practical purposes the photo-litho. process may be classified according to the two chief methods:

1. The first, in which the plate or stone is coated with the light sensitive photographic substance and exposed under a reversed negative, so that a reversed image is formed on the stone or plate which, in printing, comes in the right position.

2. The other, in which paper or a very thin zinc plate, provided with a light sensitive film, is exposed under an ordinary—that is, not reversed—negative, and thus is rendered capable of receiving fatty ink and is then transferred to the plate or stone by transfers.

The basis for the photo-litho. is generally a photographic negative on glass or a gelatinous substance which, as the word negative implies, when examined by

transmitted light, must have all its tones reversed. That is to say, to be specific, the drawing, lines, strokes or points, which are to be black in the print, must look transparent, while the other part of the negative which forms the groundwork must be covered or opaque.

Of the many processes, Fritz, the Vienes authority says, though differing in detail, they may all be assigned to one of the above-mentioned principles. However that may be, there are two which have been especially tested in practice, namely, for the direct transfer, as we will call it, that process which is based on the light sensitiveness of asphalt or of an organic substance in combination with a chromium salt; and for the indirect transfer that process which is founded on the light sensitive chromium salt in combination with gelatine, or briefly on the light sensitiveness of chromated gelatine. All other more or less complicated methods have disappeared from technical practice and have now only the honor of being scientifically and theoretically correct, but for various reasons are not practically valuable.

Until quite recently the direct process in its application to the lithographic stone or plate was uncertain in its results. It was impossible to secure sufficiently close contact between the negative and the stone or plate, particularly when large surfaces were under operation, and consequently the prints were seldom a complete success. But the successful application of the direct process to modern zinc and aluminum plates is now an accomplished fact. The metal plate is sufficiently elastic to adapt itself to any inequalities on the surface of the negative. Under such conditions as these this process offers

at least one very important advantage—there is not the slightest possibility of distortion such as might occur in the development of the transfer.

The methods used by some experimentalists for direct transfers, which began by coating the stone with a solution of gelatine, albumen, or gum made light sensitive with a chromium salt, and after exposure under a positive or negative, obtaining a printing plate, were complicated and troublesome, but the results were fairly safe and they are now more and more used in practice.

Photo-Lithography in lines is simply the reproduction of line drawings or prints in which the design is represented in black and white with such gradations that may be suggested by lines or dots. Half-tone Photo-Lithography is the reproduction of a design or copy which has in its composition gradation of tone in the form of flat tints. This is sometimes described as the translation of the graduated light and shade of the original copy into a surface which can be printed from by mechanical means for which purpose the ink bearing surface is broken up into the most minute sections, thus forming an almost imperceptible grain. The first attempt to reproduce the half-tone of a copy, in the form of a grain consisting of minute dots, were made with a screen of open textile fabric. This was done by placing the screen between the lens and sensitive plate but the results were crude and unsatisfactory. It had the effect, however, of stimulating interest, and the invention of cross-line screens soon followed. In this latter method lines were cut on glass and filled with suitable coloring matter and it was at once recognized as a decided advancement in half-tone photo

process. The screen effect, is even now a drawback to its more extensive adoption, as fine etching cannot be resorted to as in photo engraving. There are no insurmountable obstacles, however, to hinder the production of excellent transfers as this effect has to some extent been overcome by the use of a four-line screen in lieu of the usually crossed screen, while more recently a higher degree of excellence in photo process work has been attained by the adoption of a natural grain, which is undoubtedly based upon Calotype methods in which reticulated grain is produced more or less suitable for lithographic printing. Unlike the mechanical screen grain, the texture of this process reproduces the original copy with but little, if any, loss of expressive power.

There is still much to achieve in photo lithography, and it is probably more owing to a full recognition of this fact that the progressive character of the process is maintained. Its commercial value is undoubted, and its successful application is chiefly a question of how and where it can be most effectively introduced.

A photo print can now be made direct on either zinc or aluminum plates and by a slight modification of the photo engraving process can be developed according to lithographic methods. In a direct photo print on metal, the finer qualities of the work are much more likely to be retained than when a transfer print is made under the negative and afterwards transferred in the usual manner.

One authority says, in discussing photo-lithography as applied to metal plates, that the plate should be finely grained and then coated with sensitized asphalt solution

and exposed under a negative for about five minutes in direct sunlight and about twelve minutes in a diffused light. The action of light on the asphalt solution is to render it insoluble in turpentine, so that if a sufficiently exposed plate is immersed in pure turpentine the lines, etc., of the design, being of course represented by clear lines in the negative, will remain intact, while the surrounding portions will be dissolved and washed away. After development, wash the plate freely in water, and dry it by fanning or using a pair of bellows. Let it stand for about ten minutes and then slightly etch it with a very weak solution of nitric acid. Cover the work with strong fresh gum and dry it thoroughly and quickly. Remove the gum and rub up the design with black ink in the usual way, wash dry and dust over with French chalk. Every maker of metal plates supplies this special etching solution prepared for a certain quality and character of metal.

After using the etching solution and gumming up the plate should be washed out with a dry flannel till all the work is removed. Sprinkle a few drops of water on the plate with a "rubbing up" rag and with a little ink and turps rub up the work till it is gently charged with ink, then roll up till the work or transfer looks strong and sharp, when the plate is ready for printing.

Pen and ink sketches and wash drawings are entirely under the control of the artist and characteristic effects are chiefly due to bold and vigorous conception and skillful drawing. Scraper boards offer most remarkable possibilities for black and white half-tone sketches. This consists of a light wood pulp board with a convenient

base upon which a thick coating of white composition is laid. Black ruled lines are printed on this surface and lines of similar texture are embossed at right angles to them. Drawings in pen and ink may be effectively handled by free and skillful use of the scraper. Embossed lines only are the peculiar features of these boards but variety of texture can be obtained by scraping these lines into dots.

According to the existing technique of photo-lithography and the almost perfect state of the transfer process, anything can be reproduced by this method. It rests in all its branches of application on so simple a principle, that any lithographic printer with a little practice and observation, can attain absolutely good results.

Before the discovery of the method of breaking up half-tones into points or dots, only line drawings could be re-produced by photo-lithography. Since it has been possible to break up half-tones nothing stands in the way of reproducing by this method any kind of original.

The negative for photo-lithographic work must before all things possess two principal qualities; when looked through it should be as clear and as clean as possible, on the other hand the ground as well covered as possible. The deposit should be of a black color; from a well drawn original, absolutely satisfactory negatives can be prepared without the black color. When a drawing is reduced which contains grey lines, dots, and points, as well as full black ones, toned lines will be visible as well as the transparent; with careful treatment, the negative may be so far corrected that it may be used. If this is not effected, or is not possible, the retouching may be somewhat troublesome.

It will not perhaps be out of place to give here accounts of photo-lithographic methods that have recently been adopted by some of the leading printers who are at present turning out beautiful work by means of the camera and metal plates. Their method for obtaining intaglio plates is processed by first etching the original print into slight relief and then reversing it. Another process, which is similar to the latest half-tone processes, is based upon the use of an asphalt solution to give the necessary grain.

The sensitizing solution most generally used for metal photo-lithographing is prepared as follows: Take water, 1,000 parts; bichromate of ammonia, 3 parts; albumen of eggs, 100 parts and little ammonia to color the solution to a light yellow.

This mixture is well shaken, filtered with care and mixed with a spatula on a sheet of polished metal—zinc or aluminum—which has previously been cleaned with whiting. As soon as a thin coating has been obtained, it is advisable to hasten the drying by slightly warming the plate. It is then exposed to the light under a positive, after which, the exposure being judged sufficient, the metal is taken out of the frame and inked with a glue roller charged with transfer ink that has been reduced with turpentine. The plate now appears grey without any sign of the picture. The ink must not be black, but rather thin and evenly coated.

By immersing the plate in luke-warm water, the design will shortly appear. A little aid to the development can be given by the use of a small piece of raw cotton, which should be rubbed gently over the plate until the design is clear and sharp.

The image so obtained is a negative one, and the metal is bared at the points representing the black in the original. The albumen has, in fact, remained soluble at these parts, having been protected by the corresponding lines in the positive when exposed to the light in the photographic frame.

The plate is then rinsed with plenty of water, dried, and plunged into a solution of perchloride of iron at 35 degrees B, in which it should remain from ten to fifteen seconds. It is then washed again and dried. Upon again passing over the plate, which has been slightly heated, a roller charged with transfer ink, the ink adheres over the whole surface. A black picture is thus made, after which the deep parts are brought out by the aid of a smooth roller passed rapidly over the surface of the plate a few times. The picture is again developed by rubbing the surface of the plate with a piece of muslin that has been soaked in caustic ammonia. The design will now appear reversed, the image being in black, standing out from a brilliant background formed by the metal. During this operation the bichromated albumen insolubilized by the light, dissolves in its turn in the ammonia, and a second development is thus operated.

By the rubbing, and the aid of the ammoniacal liquid, the ink is removed from the parts at which the insoluble albumen is prominent, while the ink remains upon the perchloride of iron. The plate is now prepared in the ordinary way for lithographic printing, rolled up, chalked, and etched.

The metal plates used for this purpose are first well cleaned with benzine to remove all traces of grease. They

are then coated with a solution of asphalt, using a whirler to obtain an even coating. When this is properly accomplished, the plates will have a golden appearance, and are then ready for printing upon through the negative. The necessary time for exposure in sunlight is about four minutes, and about twelve minutes in diffused north light, between 10 a. m. and 2 p. m. The thicker the film, the longer the exposure.

The photo-printing frame must be of strong construction, with a pad of thick felt placed behind the plate to ensure perfect contact.

After the exposure the plate is developed in a zinc dish, with French or Neustadt oil of turpentine. Development is rapid, and usually takes from one to two minutes. In developing over-printed metal plates, an addition of Russian turpentine is of great assistance.

After development the plate is well washed and whirled to free it from water, and it is then dried in the sun for about a quarter of an hour.

It is then etched in a one per cent. solution of nitric acid; leave in the bath for about one minute, well wash with plenty of water, drain, gum up, and dry quickly.

The plate is allowed to stand for fifteen minutes, and then the gum is washed off and the plate is inked up with a soft ink. If the asphalt design does not take the ink freely, resort must be made to the rubbing-up rag charged with the ink and a little grease (such as palm oil) if necessary.

When inked-in satisfactorily, wash the plate with water, dry quickly, and dust over with French chalk. The plate is then etched with the usual etching solutions, gummed up, and dried.

It can then be washed out with oil of turpentine—without removing the gum coating—inked in solid, and rolled until clear by adding a few drops of water; then gum up and dry.

Allow the plate to rest for fully an hour, so as to allow the work to become set upon the metal. At the end of that time the plate is ready for printing.

If the plate is not accurately treated, it will scum in the rolling-up, and give dirty impressions. When such is the case, roll up the design, dry, French chalk, and etch with a weak solution of acetic acid; then rinse well.

In printing from machine it is advantageous to add a small quantity of glycerine to the damping water.

When it is found necessary to make alterations or additions to metal plates already in use, they should be well rolled-up and French-chalked. If any parts of the design are to be erased, wash out those parts with turpentine or benzine. Wipe perfectly dry and apply a small quantity of caustic soda solution to the plate by the aid of a camel-hair brush. When it is apparent that all trace of grease is removed, wash the plate, and then repeat the operation to make sure of its cleanliness.

After this, run over the plate a solution of citric acid, wash well with plenty of water, and dry quickly. It is then ready for the new work to be transferred or drawn upon it. After the alterations are completed, gum up the plate thoroughly, fan dry, and proceed as before described.

Still another process that may be used for photographing direct on the plate or stone embraces the principal of printing on to light-sensitive asphalt or an or-

ganic substance in combination with a bichromate salt. This light-sensitive asphalt, or so-called Syrian asphalt, which is prepared for photo-lithographic purposes, can be obtained from various firms who deal in photographic goods. Only that part of the asphalt is sensitive for photo-lithographic work which does not dissolve in ether. The insensitive part must, therefore, be separated out, which is done by finely powdering the asphalt, sifting it through a fine sieve, then treating it with ether. All that is soluble in ether goes into solution; the marc which is not soluble in ether is then dissolved in benzole and used as wanted.

Professor Husnik has improved this process insofar that he does not dissolve the asphalt powder in ether, as, according to his view, a complete solution of all the insensitive portion is not attained by this process, but he dissolves coarse asphalt powder completely in rectified spirit of turpentine to the consistence of a moderately thick syrupy mass, until no hard particles or a residue are contained in the solution. To this viscous asphalt solution a plentiful quantity of ether is added gradually, and with constant stirring; and a large bottle should be used for this purpose. After a sufficient quantity of ether has been added a pitch like deposit separates out at the bottom. In order to test whether there is still any light sensitive asphalt in the supernatant liquor a small quantity is poured into a glass and mixed with ether, when if a precipitate ensues more ether must be added to the large bottle. After standing for about twenty-four hours the ether contains all soluble insensitive constituents of the asphalt, the pitch-like residue in the bottle, after pour-

ing off the solution is again treated with ether, so that all turpentine is extracted and any stray and sensitive particles are dissolved. The pitchy residue is now removed from the bottle and allowed to stand in a porcelain dish in a warm place, with frequent stirring, till it is quite free from ether, and has formed a hard, brittle, black shining substance, which can be easily broken up into powder with the hand. This product is now the light-sensitive asphalt, which is dissolved for use in anhydrous benzole. As benzole is only to be obtained anhydrous with difficulty, some chloroform is added to the solution in order to prevent the running together in drying, whence the film would become unequal and patchy. The coating of the plate or stone with the asphalt film is very simple; it should be placed horizontal, then whirled rapidly on a whirler. The picture is developed with turpentine in following out this process.

Valenta recommends for photo-lithography an asphalt which has been sulphurized by the wet process, as it possesses, he says, a considerably higher light-sensitiveness than that which is not sulphurized. This process is as follows: 100 g. of raw Syrian asphalt is boiled in a retort with an equal quantity of raw pseudo-cumene which has the formula $C_6H_3(CH_3)_3$, and a boiling point of about 170 C., with 12 g. of flowers of sulphur, which should have been previously dissolved in the pseudo-cumene. When after about three or four hours boiling the evolution of sulphuretted hydrogen has ceased, the pseudo-cumene is distilled off and the black pitchy residue dissolved in benzole in the proportion of four to one hundred and used for the preparation for the plate

or stone. The sulphurized asphalt prepared according to this method is almost insoluble in ether, but dissolves fairly readily in benzole, toluene, xylene, cumene and turpentine, and is very sensitive to light. Good prints are said to be obtained from this scheme in bad, cloudy weather. For developing the asphalt image rectified oil of turpentine free from acid is used and it may be accelerated by adding Hungarian or Russian turpentine mixed with ligron, benzine or wool oil. There should be no rubbing with cotton wool, etc., in using this process.

Metal plates are best developed in a deep dish, while with the stone a wax margin should go round the drawing. After the development the plate should be well washed under a stream of water and before gumming the plate should be exposed for some time to light as this makes the ground more resistant to etching.

In coating the plate or stone with one of the above solutions it should be spread thinly and allowed to flow over the surface so as not to form unequally covered patches. The subsequent manipulations should be conducted in the dark.

Metal plates for deep etching must be well grained and polished and ought not to repel water. The plate is, after development, well washed, then allowed to dry, treated with thin gum solution, then with etching solution of tincture of galls or gallic acid and phosphoric acid and inked up.

Prints on metal plates for deep etching are gummed after development and, if the asphalt film is perfect, without rubbing up with a pad, which thickens the drawing.

It should be etched for some minutes in very dilute nitric acid.

Many lithographers are accustomed, and indeed, it is necessary with some transfers, to rub the prints up with greasy ink. This process is as follows: Greasy transfer ink is diluted with some turpentine, and after the stone or plate has been gummed and allowed to dry and then washed, the drawing is wiped over with a soft pad saturated with the dilute ink when the ink adheres to the drawing, which strengthens it. If great care is not taken in this process it will also thicken the work.

With asphalt prints this method is absolutely unnecessary and for other direct prints, as well also as for good chromated gelatine prints, this practice is useless. The exposed asphalt combines so intimately with the plate that strengthening with greasy ink is quite superfluous; is, indeed, absolutely purposeless, as the ink can neither penetrate the hard asphalt film nor combine with it. The film of asphalt alone is so resistant to every etching solution that it is for this reason entirely useless to strengthen it.

Besides the asphalt, other mixtures of other light-sensitive substances may be used for direct printing, and these are mostly organic substances in combination with a chromium salt, and possess also a greater sensitiveness to light than asphalt.

In making half-tones for the offset press an entirely different method is adopted from the same kind of a plate for the type press. In fact such fine work is being done from half-tones on the offset press that some photo-engravers are beginning to make plates especially for

that process. This is done by working direct, thereby avoiding the necessity of reversing the transfers.

The photo-engraver, in making a half-tone plate for the type printer, reverses it in the process of preparation by stripping the film from the plate of the camera, turning it over and laying it face down, causing the lettering to come out on the plate reversed and when it comes out on the printed sheet, it of course, appears properly. In making a plate for the offset press this reversing process is omitted, the reversing being done naturally when the transferrer puts down the transfer on the metal plate.

A capable transferrer need have no trouble if he will be particular to use none but first-class transfer paper in the work of reversing. Poor, old transfer paper causes more trouble in the shop where the offset press is used than any other thing which enters into the work. In case he is called upon to make a photo-lithographic transfer the transferrer should remember that this transfer paper is a specific article in every respect, the coating of which consists of a gelatinous emulsion, which can be readily sensitized, and upon which a photographic image can be developed. A bichromated, gelatine paper can be obtained by coating a hard writing paper of medium thickness with a gelatinous solution consisting of one ounce of gelatine and one ounce of water, and afterwards sensitized with bichromate of potassium. It is better to use the commercial varieties of paper and sensitize it as required. The sensitizing solution can be prepared by dissolving one ounce of bichromate of potassium in 20 fluid ounces of water. Add to this sufficient ammonia to give it a bright orange color. Keep this so-

lution in a temperature of about 60 degrees Fahr., and float the paper on it for about one minute. Pin or clip the paper to a board or squeeze it to a glass and dry in a dark room.

Correct exposure and sufficient illumination of the copy are always important factors in photographic reproductions of any kind, but they are of infinitely greater importance when applied to photo-process reproduction. One is, to a certain extent, dependent upon the other. The former must of necessity be controlled by the latter; yet no amount of exposure will compensate for defective illumination. Where artificial light is employed the advantage of using two lights is obviously great. Apart from the greater brilliancy and intensity of the light the illumination of the copy is more evenly distributed. In scraper-board copies no shadows are thrown from the embossed dots or lines, and the granular texture of grained papers is entirely eliminated.

The original for reproduction must be on the same optical plane as the sensitive plate in the camera; that is, they must be on the same parallel.

One of the latest inventions calculated to improve photo-lithography is a French process by which the inventor affirms that he can give results which are perfect as to gradation of tint and fineness of modeling, reproducing with the greatest fidelity all the detail and tone of the photographic negative. The surface of the stone or plate is first finally grained by the methods ordinarily employed in lithography, and it is important to obtain a grain of absolute uniformity and regularity. After the graining there is a process of cleaning up by

means of a weak solution of nitric acid, and the surface is then rapidly dried. It is then slightly warmed, and the surface thinly covered with a preliminary coating of gelatine, the stone or plate being then maintained at a temperature of forty degrees centigrade, or one hundred and four degrees Fahrenheit, until completely dry. A solution of albumen, twenty parts, saccharic acid, ten parts, to water two hundred parts, is then applied over the substratum of gelatine and dried. Two other solutions are then prepared, first chrysaniline, 2 grammes, chloride of zinc 50 grammes and water 100 c.c. The second solution is made up of bichromate of potash 14 grammes, bichromate of ammonia 30 grammes to water 1,000 c.c. For use in mixture equal parts of the two solutions is taken, and this is flowed over the stone or plate, which is then raised to a vertical position to allow the excess of the solution to drain off. When the coating is dry, the exposure is made under a photographic negative; in a good light of normal intensity the exposure varies from ten to fifteen minutes. A special ink is made for rolling up, consisting of convenient proportions of lampblack, venice turpentine, and black writing ink, mixed while made hot, and to which is also added a paste composed of bitumen and resin powdered very fine, and beef fat. This ink is well distributed with a hard roller, and the surface of the stone or plate well rolled with it all over. The image is developed by passing very lightly over the surface a sponge saturated with water. When the print has been developed clean, the stone or plate is then well gummed and dried. The surface is sponged over to remove the gum, the ink cleaned

off with turpentine, and the work is then etched with a weak solution of nitric acid for removing the sensitive film. It is to be remarked that with this process the photographic image is applied direct, the coating which has served for sensitizing being destroyed by the application of nitric acid before the last inking. The method is said to be excellent for the perfect reproduction on stone and metal of photographs from nature, pen and ink designs, water colors, etchings, etc., and can be applied with success to three or four-color work.

The most convenient method for a lithographer working on stone to follow to convert a positive printing image into a negative is the following: A good stone is first ground in the ordinary way and then the surface rubbed with a pad and oxalic solution till it has a high gloss or polish. On to this stone is then transferred sharp impression in a non-greasy ink from the positive printing image. According to the destination of the stone for large or small editions one of two processes may be adopted. If a thousand or more pulls are required from the stone the transfer may be dusted with resin powder, and this melted with the burning, heating, or ether process and the drawing etched in relief with 8 to 10 nitric acid and gum. Then the stone may be well washed with water and the acid removed with one to two per cent. acetic acid. For small runs the etching is omitted and the stone treated with ascetic acid. In both cases the stone should be well washed, dried, and then coated with dissolved lithographic tusche or autographic ink. The greasy substances of these materials penetrate into the surface of the stone that is laid bare, and firmly

adhere. When the tusche or ink is completely dry the stone is washed with turpentine, inked up, and one now has a negative image from the subject in question which shows all the original printing places in white and all white places black.

The facts contained in the foregoing are all important factors in photo-lithography, and their importance and influence upon the reproduction of originals can scarcely be overestimated.



Solutions, Formulas and Useful Information Epitomized

ETCHING and other solutions used in metal plate printing are supplied by those who manufacture the various plates, and it is well to use such, and follow out the directions given by the manufacturers. It is only reasonable to suppose that those who have passed through the experimental stages should be able to give the best means to attain the desired end. After some experience in working some modifications of the appended recipes will very likely be found to answer as well, if not better, than attempting to carry out literally the directions given; careful observation and practice will greatly assist the printer in these matters.

There are various solutions necessary for the proper working of metal plates. They are not of a complex nature, but at the same time it is imperative that they should be carefully attended to, if successful printing from these plates is to be obtained. For those who wish to prepare their own plates the following formulas are given. When the plate has been roughened and attains a smooth, even grain, the following solution is prepared:

Concentrated solution of alum, 20 parts; phosphoric acid, 2 parts, and 20 parts of water; or alum solution, 10

parts, gallic acid, 15 parts; nitric acid, 2 parts to 30 parts of water.

After the transfer the plate is gummed and then etched with an etching solution consisting of 10 parts of gallic acid, 2 parts of phosphoric acid, 10 parts of gum solution, to 30 parts of water; this being allowed to act for 30 or 40 seconds. The photographic-lithographer will frequently require the lithographic Tusche for additions or for corrections. The Tusche must be tolerably brittle and dissolve in distilled water and flow fine and clean from the pen. These ingredients should be melted together by boiling: 2 parts of yellow wax, 2 parts of nut-ton tallow, 6 parts of Marseilles soap, 3 parts of shellac, and $\frac{1}{2}$ part of lampblack.

A good autographic ink which draws in brown may be obtained from the following formula: 10 parts of Marseilles soap, 10 parts of tallow, 12 parts of shellac, 12 parts of yellow wax, 5 parts of mastic, 4 parts of asphalt, 3 parts of vinesoot, to 125 parts of water. Originals prepared with this ink transfer as well immediately as after several months, and ordinary well-sized writing paper can be used for drawing or writing on.

Fatty crayon used by photo-litho work is composed of: 30 parts of wax, 24 parts of Marseilles soap, 4 parts of tallow, 1 part of shellac, and 6 parts of lampblack, while lean crayon consists of 12 parts wax, 8 parts Marseilles soap, 2 parts tallow, 10 parts shellac, and 4 parts lampblack.

Any good transfer ink can be used for a developing ink, as this is applied with a roller. It usually consists of equal parts of tallow, wax, soap, some resin, and as

much lithographing ink as all the other ingredients put together.

Thin developing inks can be prepared by diluting good transfer ink with equal quantities of wax, benzine and turpentine.

The following formulas are given for etching or desensitizing solutions: Original etching solution, 12 parts gum solution and 1 part, 20 per cent. phosphoric acid. This is a weak etching mixture, and a few drops of red ink should be added to color it, so that it may be easily distinguishable from the stronger solution.

A Transfer Etching Solution: 8 parts gum solution and 1 part, 20 per cent. phosphoric acid.

Both of the above formulas should be prepared two or three days before they are required, and well shaken or mixed before using.

An Aluminum Counter Etching Solution: Add crystallized oxalic acid to a pint of warm water till a saturated solution is obtained; that is, until the crystals have dissolved. Then mix 4 parts of this acid with 96 parts of distilled water.

A good cleaning preparation may be obtained by pulverizing finely 4 parts of crystallized oxalic acid and 4 parts Terra di Siena, and dissolve in water. Apply with quill or glass hair pencil. Concentrated sulphuric acid may also be used as a cleaning preparation.

An Acid Bath, consisting of 1 part nitric acid, 45 per cent. (must be free from chlorine) and three parts water, is very good; or the following may be utilized as a substitute: 3 parts nitric acid, 45 per cent. (must be free from chlorine), 5 parts fluorsilicic acid, and 42 parts water.

As a washing-out fluid, melt over a moderate fire these ingredients: 10 ounces of yellow wax, 14 ounces of Venetian turpentine, 4 ounces of tar, and 18 ounces of the best black ink. When the whole is melted and in a liquid state, add, while stirring, 36 ounces of pulverized asphalt, dissolved in 1 pint of Benzoline. The mixture is then diluted with 10 pints of turps and is then ready for use. For a smaller quantity than the above recipe, the proportions may be halved or quartered.

The following recipe for the same liquid is given by another expert: Dissolve 1 ounce of wax, 1 ounce of Stearine, 2 ounces of asphalt, 1 tablespoonful of Terebene, 1½ pints of turpentine, and ½ ounce of re-transfer ink.

The reader will notice that in the recipes for the washing-out fluid there are two distinct classes of ingredients. First, the grease solvents; secondly, the greasy bodies which do not evaporate, but will, with the aid of the solvents, be spread over the work, which thus receives a coating of greasy matter which strengthens the transfer, and enables it to take on more readily the ink for further preparation, while, at the same time, the dry gum still remaining protects the other parts of the plate, so that they do not receive the grease from the solution.

An affinitising bath with the following constituents is recommended: 6 ounces of nitric acid, ½ pound of powdered alum, to a gallon of water. The alum is best dissolved in warm water.

To etch after the drawing has been laid down this solution is suggested: Equal parts of ammonium silicofluoride and ammonium nitrate.

Another good metal plate etching solution is:

Nut gall solution.....10 ounces

Gum arabic solution.....20 ounces

Phosphoric acid $\frac{1}{4}$ ounce

Nitric acid $\frac{1}{2}$ ounce

The strength of this preparation can be altered to suit the plate.

The best wash-out fluid for the transferer is said to be the following formula:

Asphaltum powder 1 pound

Beeswax $\frac{1}{4}$ pound

Tallow $\frac{1}{4}$ pound

Turps 5 pints

Benzole 1 pint

Oil of tar..... $\frac{1}{4}$ pint

Lavender oil 1 ounce

This liquid solvent when sprinkled on the roller softens the black ink, and the effect is to render a less adhesive substance, making it more readily imparted to the greasy transfer image.

Taken altogether, the very best etch for zinc plates so far discovered is a solution made up as follows: Nitrate of Ammonium, 21 parts; Bi-Phosphate of Ammonium, 20 parts; Gum arabic, 200 parts, and water, 750 parts.

Lithographic printing inks are generally stiff and strong in body when received from the makers and require to be reduced before they are used for printing purposes. The medium of reducing them is principally varnish, which is used in several degrees of consistency. It is prepared in various ways, but for lithographic work

that obtained from the best linseed oil alone gives excellent results.

There are various kinds of gums, gum-resins and resins, all of which are the products of different trees. To the eye some of these resemble each other so closely that it might be difficult to tell the one from the other. There is, however, this remarkable difference in character that the gums proper are all soluble in water and insoluble in spirits; while the resins proper possess exactly the opposite quality, being soluble in spirits and insoluble in water. These two opposite properties are invaluable in the lithographic process. The gum used for lithographic purposes should be pure gum arabic, sold, it may be, under different names which generally indicate the district from whence it came.

A gum solution should not be allowed to get sour, which it will do in eight or ten days in winter and half that time in summer. There are certain preventives, such as the addition of a little camphor, carbolic acid, or the essence of cinnamon; and there is a remedy for the sourness when it has taken place, in the addition of a little powdered chalk. But by far the safest plan is not to allow it to get sour at all. This is easily effected by dissolving only a few days' supply at a time and keeping the sponges and pot perfectly clean. The action of sour gum is most detrimental to good work.

To ascertain the good quality of printing ink you have merely to take a sheet of unsized paper and spread a little of the ink to be tested upon the surface. Some hours later the ink will be surrounded with an edge formed by the varnish. When the ink is good this edge

is invariably white, and, on the contrary, when bad it is of a more or less deep yellow color. Such ink could not give satisfactory results in printing. This yellowness is sometimes due to defective boiling of the varnish or imperfect calcination of the black employed. These remarks do not apply to cheap, common inks, but to inks of some value.

Good ink should be black, brilliant, unctuous, too thick rather than too thin, and should dry rapidly. The finer an ink is the better its siccative properties. Petroleum should never be added to ink to make it less strong. The degree of strength or excessive siccativeness can be reduced by mixing the varnish with the ink.

Good recipes for paste and glue, which are the result of experience, are given below: Dissolve half an ounce of the purest white glue in half a pint of rain water and add four ounces of the lumps of gum arabic. This is a good glue for pressmen and for general purposes. To make it pliable for setting gauges and for bookbinding, where a quick-drying glue would not answer, add a little glycerine. You can whiten common glue by adding oxalic acid.

A fire and water proof glue is a handful of quicklime mixed with four ounces of linseed oil, thoroughly mixed, boiled to the consistency of syrup and spread on thin plates in the shade. It hardens and is then dissolved like common glue, when it is ready for use.

A fire, water, weather, acid, and rust-proof cement that can be used to fasten nearly every imaginable substance—metal, glass, woods, etc.—is litharge and glycerine mixed to the consistency of thick cream. The mended or joined articles should not be used for from a day to a

week, according to quantity of cement used, as it is a slow drier.

A fine paste—none better for bindery and press work, especially for rotary presses—is made by mixing good flour with rain water, rapidly boiling to a paste and adding a little carbolic acid, the best preventive of souring. Do not use alum, acetic acid or borax, as some do, for this purpose. Strain the paste through a very fine sieve and it is ready for use.

Tusche, or litho drawing ink, is something that every lithographer should know thoroughly. The main thing is that it should contain fat and soap; the first substance is put in for the purpose of resisting acid, which must be applied to prepare the clean litho surface upon which it is used; the second substance is placed there to combine with the plate or stone, through the action of nitric acid, into a saponaceous material, resulting in that strong, permanent hold which the work then obtains. In order to fulfill this requirement, the soap used for making such ink should contain the greatest amount of oil in combination with alkaline bodies; or, in other words, fatty acids, and for this reason Marseilles soap, which contains nearly 20 per cent. more of this acid than the ordinary soap, is preferred by some in making this ink or litho Tusche. In addition to this there is wax, or spermacetti, added also for their greasy qualities; further shellac, pitch and mastic, to help bind the first-mentioned material together, and finally, as it would be impossible to draw fine lines, dots, or close textures with an almost colorless fluid, lampblack, in its finest state of reduction, is added simply to give color. The greatest amount of care should be exercised in the mixing, owing to the diversity of the substances used.

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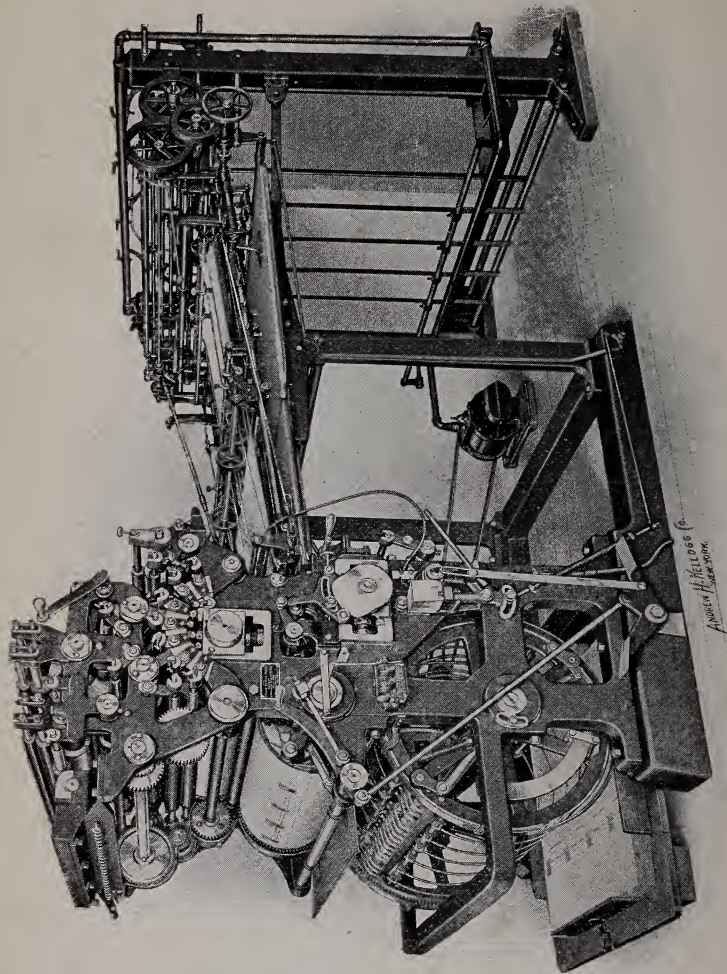
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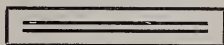
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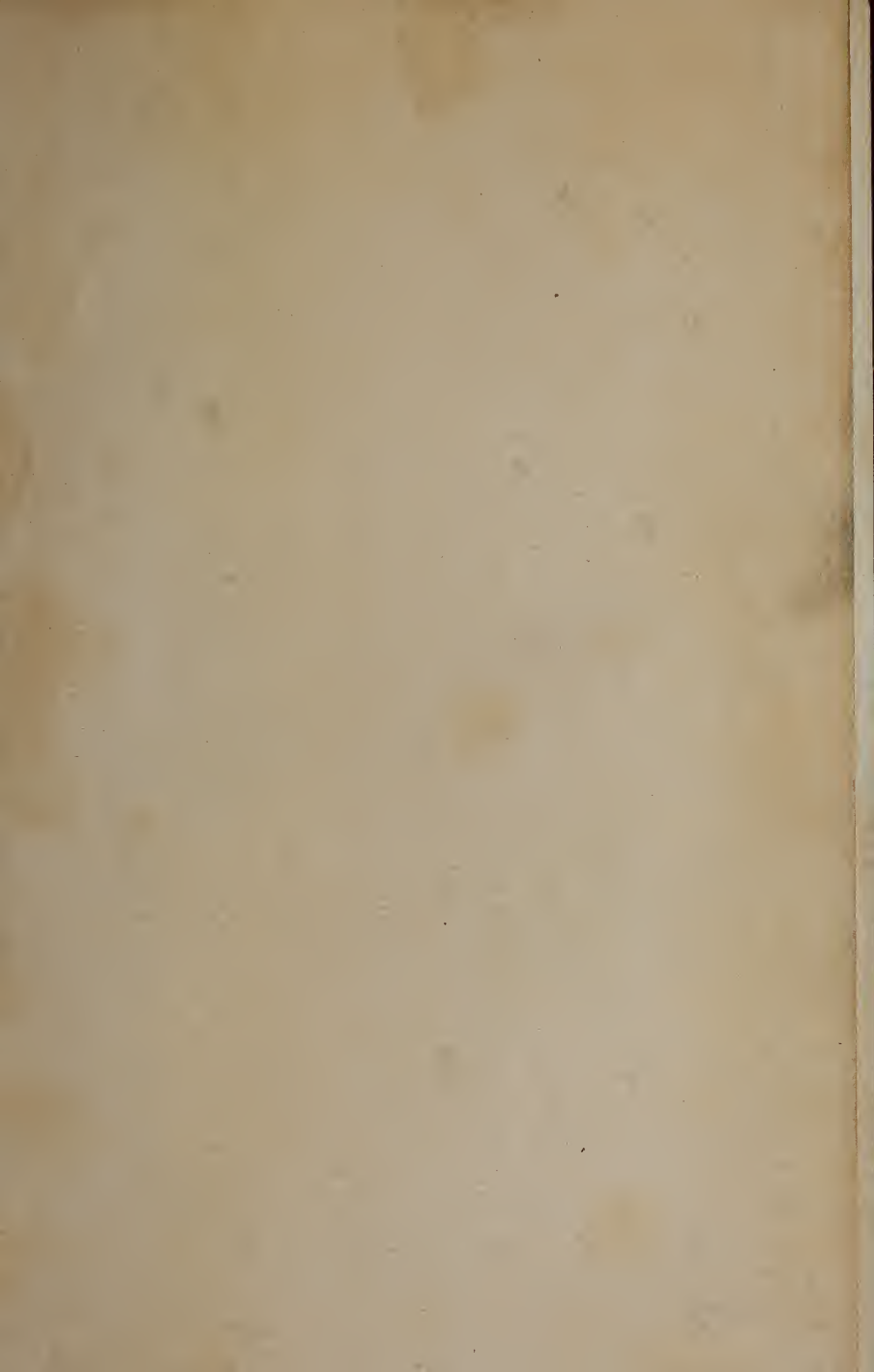
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